Results of forest insect and disease surveys in the ALGONQUIN REGION of Ontario, 1990

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

C.J. Jones and P.M. Bolan

Miscellaneous Report No. 104

Forestry Canada Forêts Canada

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FORESTRY CANADA, ONTARIO REGION

Ontario Region is one of six regional establishments located across Canada and operated by Forestry Canada. The overall objective of Forestry Canada is to promote the preservation, enhancement and wise use of a healthy, attractive and bountiful forest resource and terrestrial environment for the economic and social benefit of all Canadians. Ontario Region pursues this objective by conducting two major programs: research and technical services and forestry development. Both programs address major problems affecting forest management and the forest environment primarily in Ontario, but because of the transprovincial nature of the forest resource, many elements of our research program are of national significance.

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Major activities in forestry development include federal management responsibility for federal-provincial forest management agreements, participation in the National Forestry Statistics program and forest economics research.

Close working relationships are maintained with the Ontario Ministry of Natural Resources, the forest industry, educational institutions specializing in forestry and the biological sciences, and other forestry organizations within the province. Ontario Region is represented on the Ontario Forestry Council and the Ontario Forestry Research Committee, which have responsibility for coordinating forestry research in Ontario.

It is recognized that forested land must be managed in the best public interest, not only for the wood production essential to our economy, but also for the recreational purposes that are so important to our social well-being. This must be achieved in a manner that will maintain or improve the quality of the forest environment and preserve it for generations to come.

RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE ALGONQUIN REGION OF ONTARIO 1990

(FOREST DISTRICTS: PARRY SOUND, BRACEBRIDGE, ALGONQUIN PARK, PEMBROKE, MINDEN AND BANCROFT)

C.G. JONES and P.M. BOLAN

FORESTRY CANADA

ONTARIO REGION

GREAT LAKES FORESTRY CENTRE

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SURVEY HIGHLIGHTS

This report reviews the more important insect, disease and abiotic conditions encountered during aerial and ground surveys of the forested areas in the Algonquin Region of Ontario in 1990.

The gypsy moth has begun to displace the forest tent caterpillar as the forest pest with the biggest impact on hardwood forests. Gypsy moth was responsible for 39,235 ha of medium-to-heavy infestation. The area infested by the forest tent caterpillar decreased to 192,170 ha and further decreases are predicted. High population levels of the saddled prominent occurred in the Region after a 20-year absence. Large numbers of jack pine budworm reappeared after only a 3-year absence and caused 29,660 ha of moderate-to-severe damage, and the Region once more contains a large area (2,815 ha) of medium-to-heavy infestation by the spruce budworm. The pine false webworm continued to have a significant impact on red pine plantations, prompting control operations by the Ontario Ministry of Natural Resources (OMNR).

Surveys for Scleroderris canker, especially infection by the European race of the fungus, were again conducted and positive identifications were reported in four red pine plantations. One report in Stephenson Township, Bracebridge District, represented an extension of the geographic range of this fungus. Insect infestations and drought have taken their toll on the forests; surveys revealed 336,379 ha of stress-related foliar discoloration and 16,060 ha of moderate-to-severe dieback and whole-tree mortality.

Twenty-nine sugar maple health plots, the three oak health plots, six Acid Rain National Early Warning System (ARNEWS) plots and the four North American Maple Project (NAMP) plots were re-evaluated.

As in previous years, pests in this report are categorized as follows:

Major Insects/Diseases

capable of causing severe injury to or death of living trees or shrubs

Minor Insects/Diseases

capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs

Other Forest Insects/Diseases (Tables)

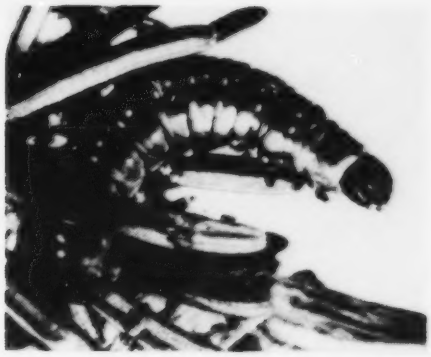
These tables provide information on two types of pest:

(1) those that are of minor importance and have not been known to cause serious damage to forest trees, and

(2) those that are capable of causing serious damage but, because of low population levels or for other reasons, that did not cause serious damage in 1990.

The valuable assistance and cooperation extended to the authors by OMNR during the 1990 field season are gratefully acknowledged.

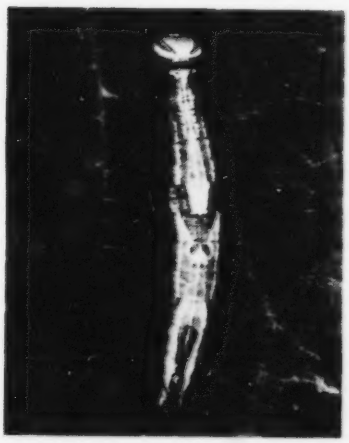
C.G. Jones
P.M. Bolan



Spruce budworm
(*Choristoneura fumiferana* Clem.)

Jack pine budworm
(*Choristoneura pinus pinus* Free.)

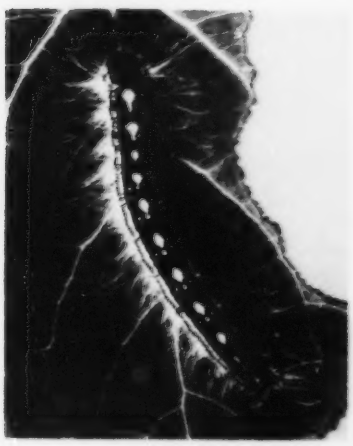
Pine false webworm
(*Acantholyda erythrocephala* [L.])



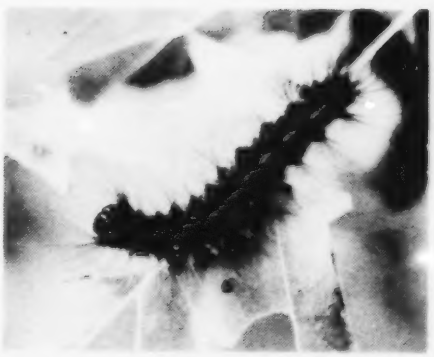
Saddled prominent
(*Heterocampa guttivita* [Wlk.])

FRONTISPIECE

Major insect pests in Algonquin Region in 1990.



Forest tent caterpillar
(*Malacosoma disstria* Hbn.)



Gypsy moth (*Lymantria dispar* [L.])

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INSECTS

Major Insects

Pine False Webworm, *Acantholyda erythrocephala* (L.)

This introduced webspinning sawfly (see Frontispiece) was the insect pest with the greatest impact on planted red pine (*Pinus resinosa* Ait.) in the Region. Large populations continued to infest red pine of different ages, causing moderate-to-severe defoliation on 1.4- to 4.0-m-high planted trees. Overall defoliation ranged from 6 to 86%, although moderate-to-severe defoliation (>75%) of single trees or groups of trees was recorded at each location (Fig. 1). The large numbers encountered in the previous year prompted the Ontario Ministry of Natural Resources (OMNR) in Parry Sound and Minden districts to undertake control operations in a number of Woodland Improvement Act (WIA) properties. A white pine (*Pinus strobus* L.) seed orchard in Bancroft District was also treated. In all, 137.5 ha were sprayed with the chemical insecticide carbaryl (Sevin®). Research staff from the Forest Pest Management Institute and Great Lakes Forestry Centre of Forestry Canada conducted spray trials against pine false webworm in a plantation in Parry Sound District with various concentrations of carbaryl and permethrin (Ambush®).

Parry Sound District, especially the eastern portion, hosted some of the largest populations in the Region. In all, 110.8 ha in 12 WIA plantations in McMurrich and Ryerson townships were sprayed with carbaryl (2.4 mL of product per litre of water applied from an all-terrain vehicle with a Hardi T54 boom sprayer). A post-spray defoliation estimate was carried out in McMurrich Township in one of the treated areas that had received a late application of the pesticide. This assessment disclosed that all of the 3.4-m-tall red pine were affected, and overall defoliation averaged 86% (Table 1). Another area was evaluated in McMurrich Township in the untreated parts of the plantation in which Forestry Canada researchers conducted spray trials. The defoliation survey indicated 97% of the 1.4-m-tall red pine were affected and defoliation averaged 45%. Defoliation in the parts of the plantation sprayed with different concentrations of carbaryl averaged 21%; defoliation in the permethrin-treated plots averaged 36%.

Four red pine plantations totaling 22 ha were treated in Minden District with 0.3% carbaryl in water. The chemical was applied in one plantation with a Rittenhouse sprayer towed by an all-terrain vehicle and the others were sprayed with a skidder-mounted air-blast sprayer. A post-spray assessment in a plantation sprayed twice in Snowden Township disclosed 85% of the 2.3-m-high trees were damaged and defoliation averaged 18%. A 4.7-ha area of a white pine seed orchard was also sprayed with carbaryl in Cardiff Township, Bancroft District, at an application rate of 0.6 mL of chemical per litre of water; a Rittenhouse portable wheeled sprayer was used. No follow-up assessment was done.

ALGONQUIN REGION

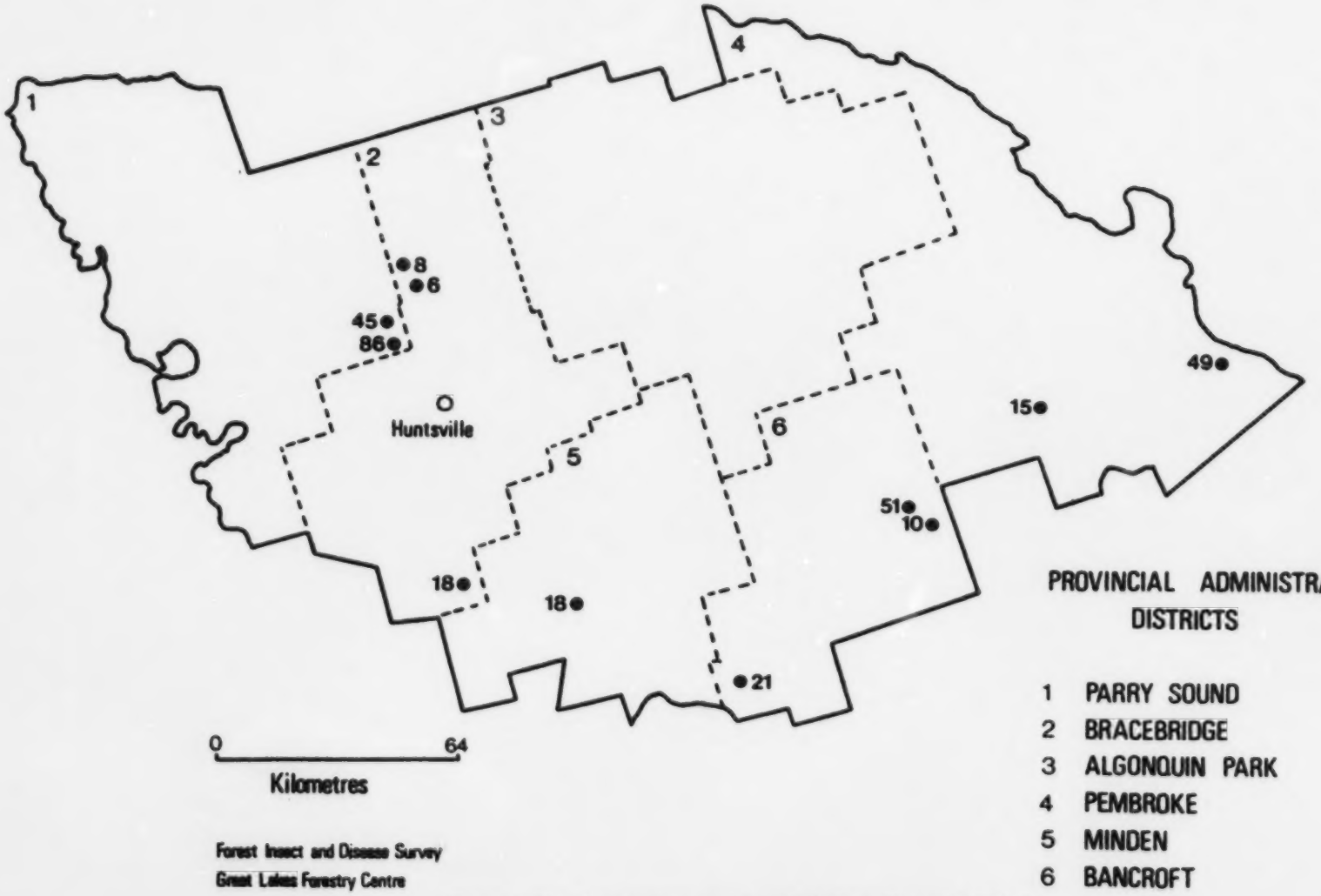


Figure 1. Pine false webworm (*Acantholyda erythrocephala* [L.])
Locations of areas surveyed and average defoliation (%)

Table 1. Damage caused by the pine false webworm at 11 locations in the Algonquin Region of Ontario in 1990 (counts based on an examination of 100 or 150 randomly selected trees at each location).

Location (Twp)	Tree species[a]	Avg. ht. of trees (m)	Estimated trees per ha	Estimated area affected (ha)	Trees affected (%)	Avg. defol. (%)
Bancroft District						
Burleigh	rP	3.0	2000	4.0	67	21
Mayo	rP	1.9	2200	2.5	52	10
Mayo	rP	4.0	2000	2.0	99	51
Bracebridge District						
Armour	rP	1.9	3100	25	60	8
Armour	wP	1.9	2000	2.0	57	6
Ryde	rP	1.1	2900	7.5	45	18
Minden District						
Snowdon	rP	2.3	2300	5.0	85	18
Parry Sound District						
McMurrich	rP	1.4	2500	18	97	45
McMurrich	rP	3.4	2500	14	100	86
Pembroke District						
Horton	rP	2.3	2200	13	99	49
Sebastopol	rP	1.6	2500	4.0	63	15

[a] rP = red pine, wP = white pine

Large numbers of the webworm were recorded at several other locations. The most noticeable damage occurred in a plantation of 4-m-high red pine in Mayo Township, where 99% of the trees sustained defoliation averaging 51%. Surveys in two other plantations, one in Mayo Township and one in Burleigh Township, revealed that 52 and 67% of the trees were affected, and defoliation averaged 10 and 21%, respectively.

Moderate-to-severe defoliation was recorded at three locations in Bracebridge District, of which one was a white pine plantation. Here, 57% of the 1.9-m-tall white pine were attacked and defoliation averaged 6%, but individual-tree defoliation as high as 90% was recorded. In the other two areas, 45 and 60% of the red pine in Ryde and Armour townships were attacked, and associated damage averaged 18 and 8%, respectively.

Two red pine plantations with high population densities of the webworm were assessed in Pembroke District. In a 13-ha portion of a 20-ha plantation of 2.3-m-high trees in Horton Township, 99% of the trees were attacked and defoliation averaged 49%. Evaluation in a 4-ha portion of an 18-ha area in Sebastopol Township revealed that 63% of the 1.6-m trees were affected and defoliation averaged 15%.

An egg parasite (*Trichogramma* sp.) collected in Snowdon Township, Minden District, represented the first North American record of a parasite attacking the eggs of pine false webworm. The find was also significant because it offers the potential for a possible biological control agent for the pine false webworm.

Eastern Spruce Budworm, *Choristoneura fumiferana* (Clem.)

Provincial Situation

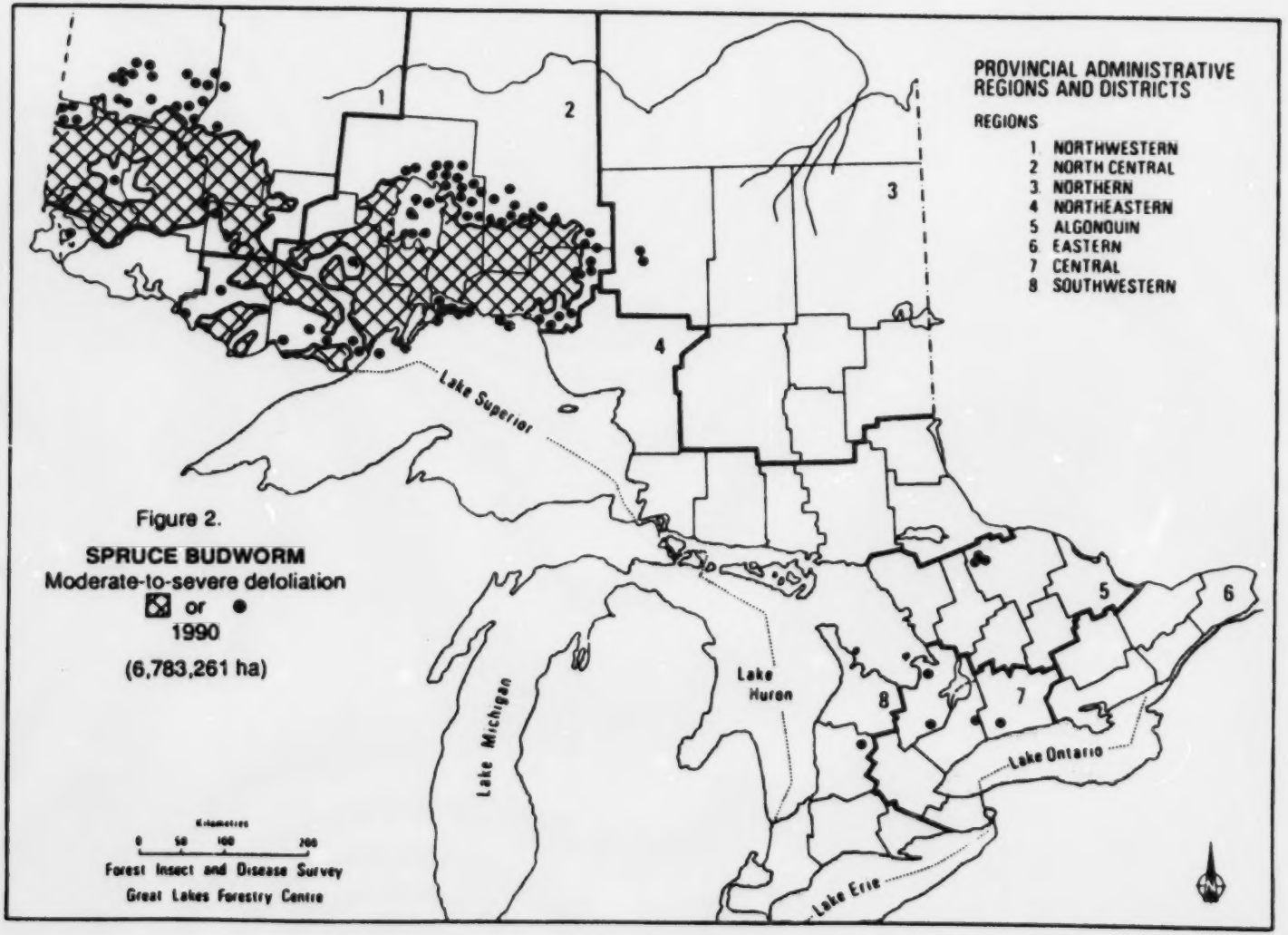
A slight increase in the area of moderate-to-severe defoliation was recorded in the province, with the largest widespread areas confined to parts of the North Central and Northwestern regions (Fig. 2). Smaller medium-to-heavy first-year infestations were reported in the Algonquin and Northern regions. As well, moderate-to-severe defoliation occurred in a number of white spruce (*Picea glauca* [Moench] Voss) plantations in the Central and Southwestern regions. Over all, the area of moderate-to-severe damage increased from 6,239,636 ha in 1989 to 6,780,446 ha in 1990. Associated whole-tree mortality and top kill of balsam fir (*Abies balsamea* [L.] Mill.) and white spruce increased by 1,214,473 ha, to 16,259,347 ha. The first occurrence of whole-tree mortality in Algonquin Region was recorded in 1971.

A protection-spray program was conducted by OMNR in North Central Region, where a total of 49,627 ha of Crown forests were aerially sprayed with the bacterial insecticide *Bacillus thuringiensis* (B.t.).

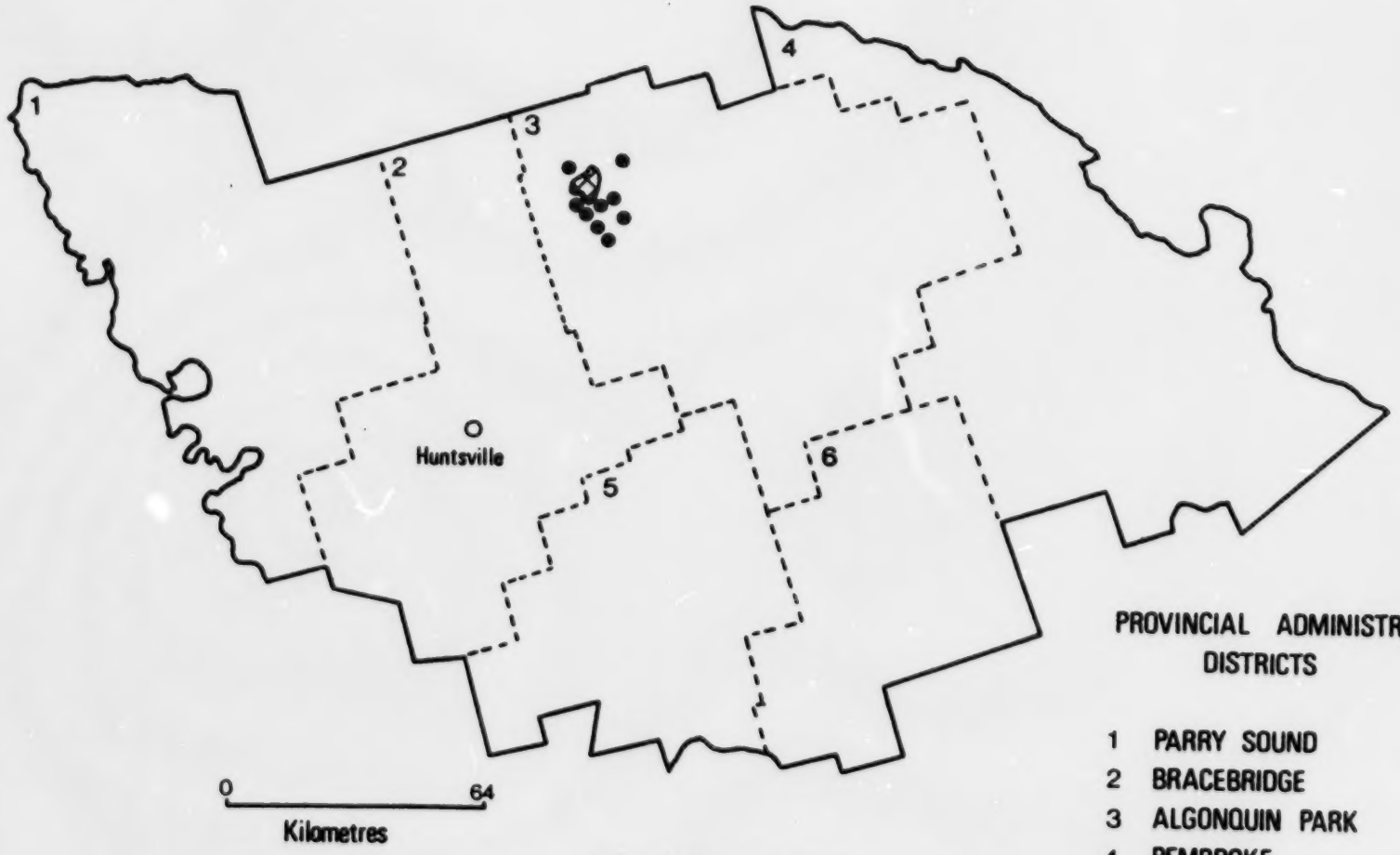
Algonquin Region

Aerial and ground surveys located the first occurrence of moderate-to-severe defoliation by the budworm (see Frontispiece) since the collapse of the last infestation in the Region in 1986. The previous infestation in the Region started in Pembroke District in 1967; whole-tree mortality of hosts was reported in 1971. The effects of this last infestation are still present as dead balsam fir and white spruce, most of which are now on the ground. Some of the older white spruce continue to decline from the combined stress of repeated defoliation and drought, factors that have predisposed them to attack by secondary agents such as Armillaria root rot (*Armillaria ostoyae* [Romagn.] Herink); details are contained in the 1989 version of this report. The current area of moderate-to-severe damage was confined to Algonquin Park District (Fig. 3). The largest part of the infestation was in the Gibson-Loughrin lakes area of Biggar Township. Additional pockets of damage occurred in the southern part of Biggar Township and the northern part of Devine Township in the Shag, Loontail and Coldsprings lakes area.

Egg-mass sampling was carried out at 12 locations in the Region: in Biggar, Devine, Stratton and White townships, Algonquin Park District; in Bethune Township, Bracebridge District; in Hindon Township, Minden District; in Mowat and Spence townships, Parry Sound District; and in Alice Township, Pembroke District. Nil or light defoliation is forecast at eight of the areas sampled; moderate-to-severe defoliation will occur at the remaining


PROVINCIAL ADMINISTRATIVE REGIONS AND DISTRICTS
REGIONS
1 NORTHWESTERN
2 NORTH CENTRAL
3 NORTHERN
4 NORTHEASTERN
5 ALGONQUIN
6 EASTERN
7 CENTRAL
8 SOUTHWESTERN
Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
Figure 2.
SPRUCE BUDWORM
Moderate-to-severe defoliation
or
1990
(6,783,261 ha)
Kilometres
0 50 100 200
Forest Insect and Disease Survey
Great Lakes Forestry Centre

ALGONQUIN REGION



PROVINCIAL ADMINISTRATIVE DISTRICTS

1 PARRY SOUND
2 BRACEBRIDGE
3 ALGONQUIN PARK
4 PEMBROKE
5 MINDEN
6 BANCROFT

Forest Insect and Disease Survey
Great Lakes Forestry Centre

Figure 3. **Spruce budworm,** ***Choristoneura fumiferana (Clem.)***
Areas within which moderate-to-severe defoliation occurred in 1990
● or ⊠

four (Table 2). Interpretation of these results indicates moderate-to-severe defoliation will recur, with some expansion from the same general area currently infested.

Table 2. Spruce budworm in Algonquin Region: defoliation estimates and egg-mass counts in 1990 and infestation forecasts for 1991.

Location	Host	Estimated % defoliation 1990	No. egg masses per 9.29 m² of foliage	Infestation forecast for 1991[a]	Accumulated damage[b]
Algonquin Park District					
Biggar Twp					
- Birchcliffe Lake	bF	8	58	M	1
- Gibson Lake	bF	84	682	S	2
- Gibson Lake West	bF	32	262	S	1
- Loontail Lake	bF	80	1500	S	2
Devine Twp					
- Misty Lake	bF	0	0	0	0
Stratton Twp	wS	1	0	0	0
White Twp	bF	1	0	0	0
Bracebridge District					
Bethune Twp	bF	0	0	0	0
Minden District					
Hindon Twp	bF	0	11	L	0
Parry Sound District					
Mowat Twp	bF	0	9	L	0
Spence Twp	bF	0	0	0	0
Pembroke District					
Alice Twp	bF	0	0	0	0

[a] S = severe, M = moderate, L = light, 0 = nil

[b] 0 = undamaged; 1 = light damage, <25% total defoliation, usually one season of severe defoliation; 2 = moderate damage, 25-60% total defoliation, two or three seasons of severe defoliation

In conjunction with the conventional system of egg-mass sampling, groups of three pheromone traps were deployed at six locations. These traps are part of a nationwide program to develop a relatively inexpensive and efficient tool for monitoring spruce budworm populations. The plastic, non-saturating traps are equipped with a synthetic pheromone and a strip impregnated with a killing agent. The traps are set in place before the adult flight period and are removed in the fall so the contents can be counted. The results of trap catches at locations common to 1989 and 1990

are presented in Table 3. These results indicate that decreased numbers of adults were captured in certain areas in 1990.

Table 3. Spruce budworm moth catches at four locations in the Algonquin Region of Ontario in 1989 and 1990 (counts based on the total number of moths from each cluster of three traps using the Biolure).

Location	No. of adults trapped	
	1989	1990
Algonquin Park District		
Stratton Twp	-	13
White Twp	-	53
Bracebridge District		
Bethune Twp	16	3
Minden District		
Hindon Twp	10	5
Parry Sound District		
Spence Twp	4	0
Pembroke District		
Alice Twp	215	24

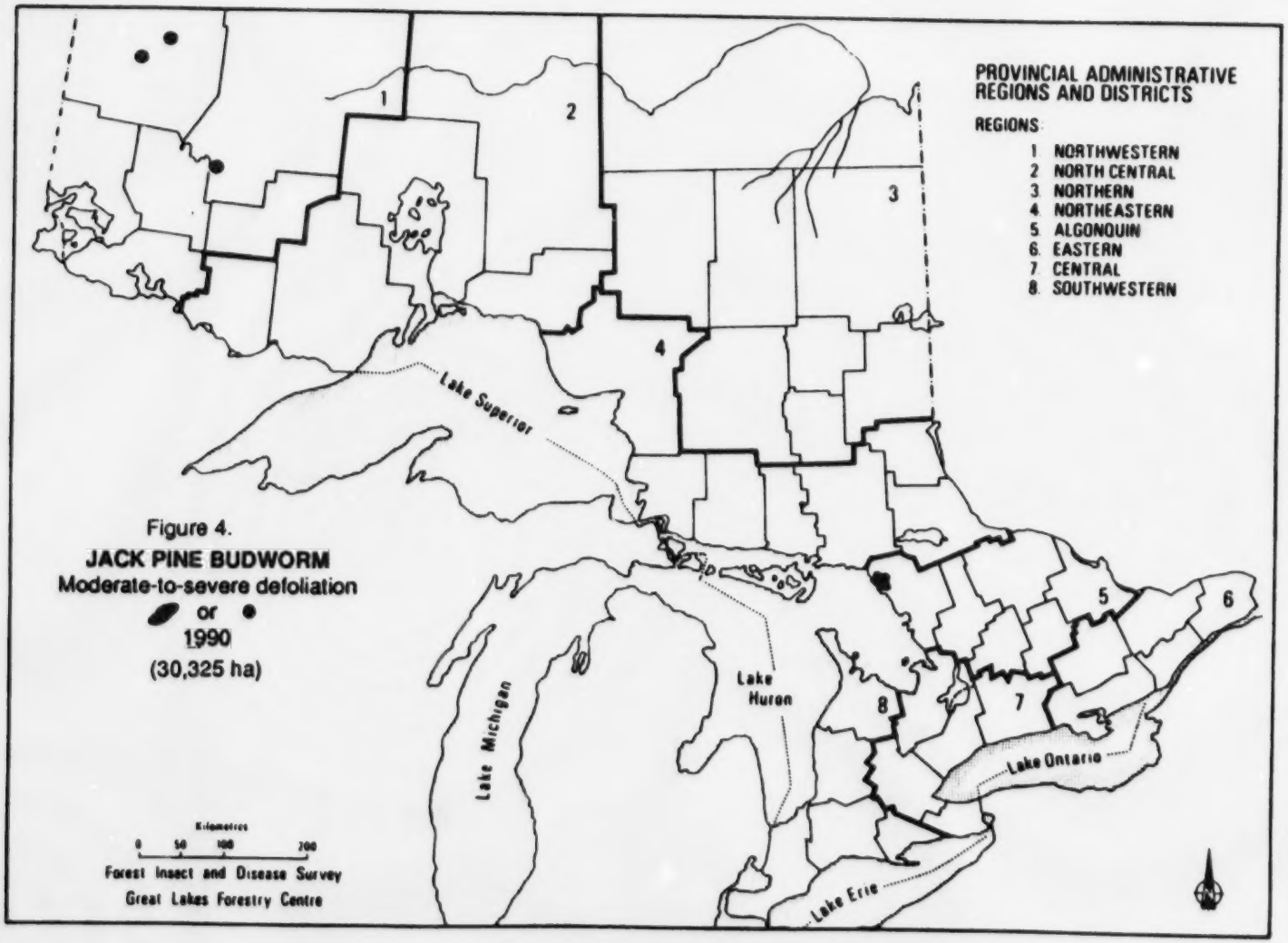
Jack Pine Budworm, *Choristoneura p. pinus* Free.

Provincial Situation

Three small pockets of mostly moderate defoliation, remnants of a declining infestation in its seventh year, were recorded in Northwestern Region and a new, substantial area of damage was reported in Algonquin Region. The total area of medium-to-heavy infestation in the province was 30,325 ha, of which 98% (29,660 ha) was confined to Parry Sound District in Algonquin Region (Fig. 4).

Algonquin Region

High population levels of jack pine budworm (see Frontispiece) appeared unexpectedly in the western part of Parry Sound District in the same general area that had recently been subjected to five consecutive years (1982-1986) of moderate-to-severe defoliation. This is only a 3-year break between infestations. The jack pine (*Pinus banksiana* Lamb.) in this area along the Georgian Bay coast are growing on shallow, rocky sites, have been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REGIONS
1 NORTHWESTERN
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6 EASTERN
7 CENTRAL
8 SOUTHWESTERN
Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
JACK PINE BUDWORM
Moderate-to-severe defoliation
or
1990
(30,325 ha)
Kilometres
0 50 100 200
Forest Insect and Disease Survey
Great Lakes Forestry Centre

Figure 4.

subjected to at least 2 years of below-normal rainfall and 5 years of moderate-to-severe defoliation, and this was followed by another season of high population levels with only a short interval between infestations. As expected, the jack pine are showing signs of stress from the combination of drought and defoliation. A 100-tree count of jack pine at one location in Wallbridge Township disclosed 13% whole-tree mortality, of which 1% was recent (death occurred during the past summer) dead tops on 33% of the trees and the remaining 54% were relatively unaffected.

The current area of medium-to-heavy infestation (29,660 ha) encompasses an area along the Georgian Bay coast extending north of the Charles Inlet-Gordon Lake area to the Still River area (Fig. 5).

Egg-mass sampling for the purpose of population forecasting was carried out at 16 locations in the Region. Seven of the sample areas were in the Algonquin Park and Pembroke districts; no eggs were found, so no defoliation is expected in these areas in 1991 (Table 4). The remaining nine egg-mass sampling locations were in Parry Sound District, and the results in Table 4 indicate that the same general area will be reinfested in 1991, with some southward expansion.

Larch Casebearer, *Coleophora laricella* (Hbn.)

Increased populations of this introduced pest and associated moderate-to-severe foliar damage were recorded at several locations in the western part of the Region. Foliar damage averaged 80% in a 10-ha stand of 18-m tamarack (*Larix laricina* [Du Roi] K. Koch) in Chaffey Township, Bracebridge District. Also in Bracebridge District, 60% foliar damage was noted in a 2-ha stand of 15-m tamarack in Franklin Township and on 6-m roadside trees in Draper Township. A number of small stands of tamarack were similarly affected in Minden District. A 3-ha stand in Galway Township sustained 90% foliar damage and a number of 2-5 ha pockets of 80% foliar damage occurred in Somerville Township on trees ranging from 10 to 15 m in height. Refoliation had occurred by midsummer in stands hosting medium-to-heavy infestations.

Eastern Pine Shoot Borer, *Eucosma gloriola* Heinr.

This pest attacks the current terminal and lateral shoots of pine (*Pinus* spp.) and high population levels can cause reduced growth. Attacks on terminal shoots also result in undamaged laterals vying for dominance, resulting in a tree with poor form.

Significant damage was observed in a 5-ha plantation of 2.4-m-tall red pine in Ryerson Township, Parry Sound District. Examination revealed 58% of the trees affected, with an average of two damaged laterals per tree. Much smaller populations were encountered in a 7.5-ha plantation of 1.1-m red pine in Ryde Township, Bracebridge District. Here, 1.3% of the trees were damaged with only one lateral per tree affected.

ALGONQUIN REGION

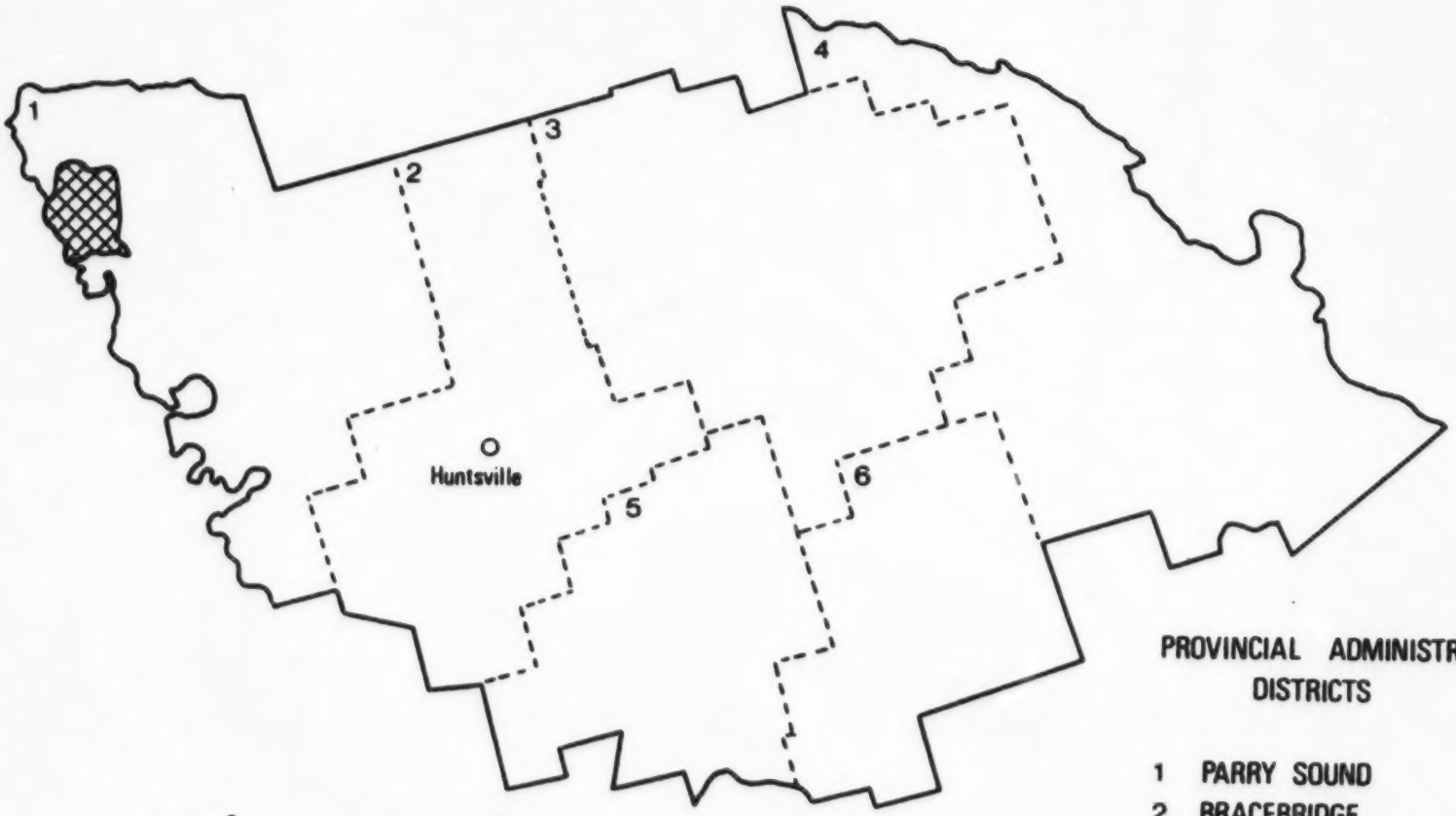


Figure 5. Jack pine budworm, *Choristoneura p. pinus* (Free.)
Areas within which moderate-to-severe defoliation occurred in 1990
● or ⊠

Table 4. Jack pine budworm in Algonquin Region: defoliation estimates and egg-mass counts in 1990 and infestation forecasts for 1991 on jack pine.

Location	Estimated % defoliation 1990	Total no. egg masses on six 61-cm branch tips	Infestation forecasts for 1991[a]
Algonquin Park District			
Edgar Twp	0	0	N
White Twp	0	0	N
Parry Sound District			
Carling Twp - Hwy 69	3	0	N
- Snug Harbour	0	1	L
Harrison Twp - Hwy 529	11	3	M
- Hwy 529A	7	7	H
- Indian Reserve 17A	36	13	H
Henvey Twp	85	87	H
Mowat Twp	1	0	N
Wallbridge Twp - Harris Lake Rd	62	36	H
- Magnetawan River	30	13	H
Pembroke District			
Clara Twp	0	0	N
Head Twp	0	0	N
Maria Twp	0	0	N
Petawawa Twp	0	0	N
Richards Twp	3	0	N

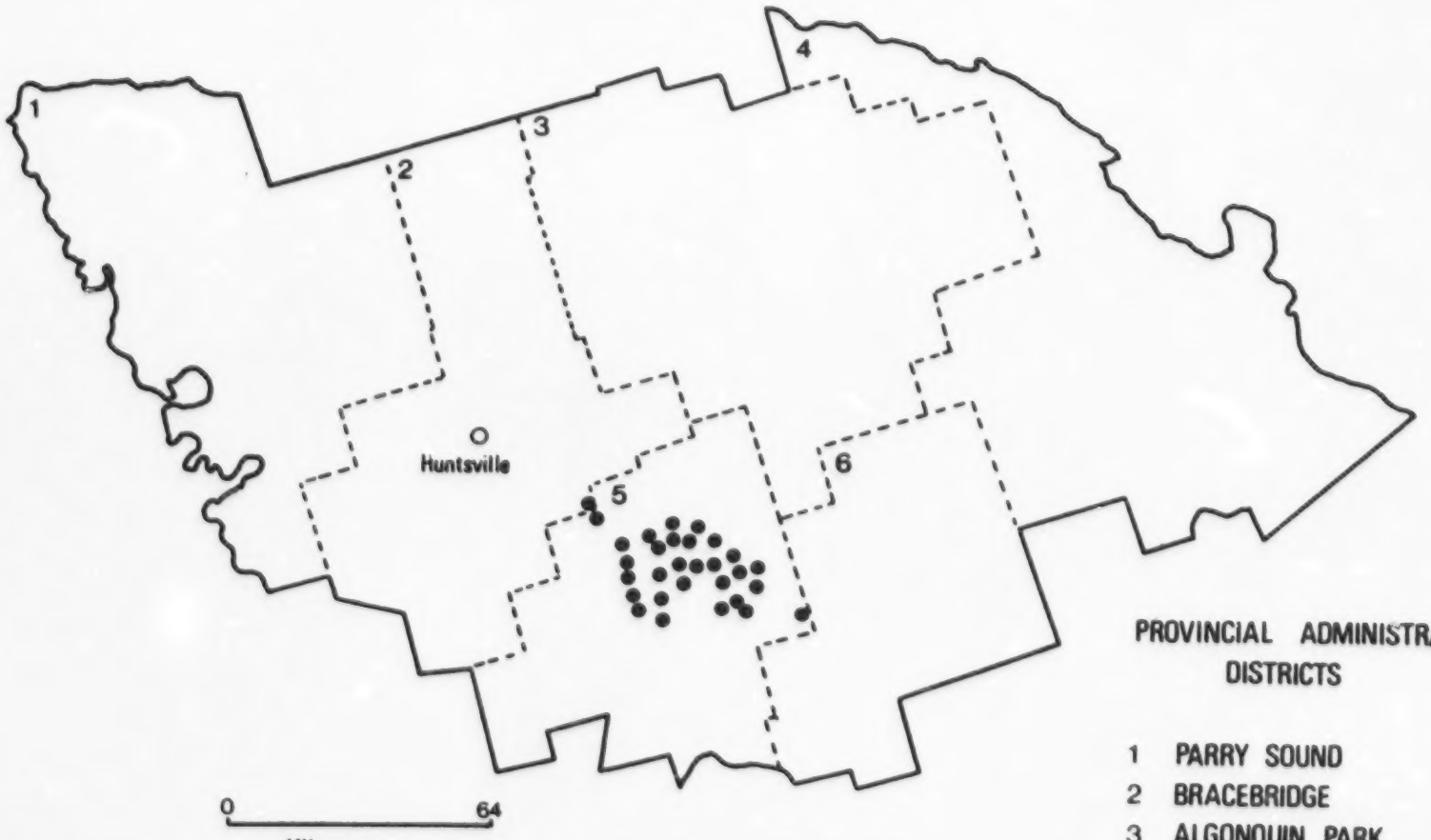
[a] N = nil, L = light, M = moderate, H = heavy

Saddled Prominent, *Heterocampa guttivitta* (Wlk.)

Large numbers of the saddled prominent (see Frontispiece) were observed in Algonquin Region after a 20-year absence. During the previous infestation, moderate-to-severe defoliation of hardwood stands was first recorded in 1968 in 10 townships near the northern Bracebridge District-Algonquin Park District boundary. The following year, the infestation expanded and some 300,000 ha of hardwood stands were affected. The infestation collapsed in 1970 and only small numbers of the insect were found.

In 1990, 2,017 ha of medium-to-heavy infestation were mapped in hardwood stands in Algonquin Region, most of which occurred in the central part of Minden District (Fig. 6). Seventy-eight pockets of moderate-to-severe defoliation were observed in parts of Dudley, Dysart, Glamorgan, Guilford, Hindon, Minden, Monmouth and Stanhope townships. As well, a small pocket of moderate-to-severe defoliation was recorded in Ridout Township, Bracebridge District.

ALGONQUIN REGION



Forest Insect and Disease Survey
Great Lakes Forestry Centre

Figure 6. **Saddled prominent,** ***Heterocampa guttivita*** **(Wlk.)**
Areas within which moderate-to-severe defoliation occurred in 1990 ●

Sugar maple (*Acer saccharum* Marsh.), yellow birch (*Betula alleghaniensis* Britton) and beech (*Fagus grandifolia* Ehrh.) were most affected; sugar maple seemed to be the preferred host. The beech caterpillar (*Dasylophia thyatiroides* [Wlk.]) was also found feeding in conjunction with the saddled prominent. In many of the infested areas, the stands had initially experienced light defoliation by the forest tent caterpillar (*Malacosoma disstria* Hbn.); low-to-moderate populations of the saddled prominent increased or continued the damage and pushed defoliation into the moderate-to-severe category. Light defoliation was observed in numerous stands in central Minden District, western Bancroft District and the eastern townships of Bracebridge District.

Fall Webworm, *Hyphantria cunea* (Drury)

Most of the damage in the Region could be characterized as single, scattered webs that caused light (usually <10%) defoliation. A variety of tree sizes and species such as black ash (*Fraxinus nigra* Marsh.), white ash (*F. americana* L.) and white elm (*Ulmus americana* L.) were commonly affected. This light damage was recorded in Ross and Westmeath townships, Pembroke District; Chaffey, McClintock and Medora townships, Bracebridge District; Carling, Mowat and Shawanaga townships, Parry Sound District; and Cavendish and Somerville townships, Minden District.

One area with high population levels was noted for the second consecutive year in a 5-ha woodlot in Bromley Township, Pembroke District, where the entire white ash component (averaging 16 m tall) experienced complete defoliation.

Gypsy Moth, *Lymantria dispar* (L.)

The Region experienced significant changes in the occurrence of medium-to-heavy infestations by the gypsy moth (see Frontispiece) in 1990. Over all, the area of moderate-to-severe defoliation increased from 1,234 ha in 1989 to 39,235 ha in 1990 (Fig. 7). Demarcation of infestations in parts of the Region was still complicated by the presence of large numbers of the forest tent caterpillar. Forested areas with a good mixture of oak (*Quercus* spp.) and aspen (*Populus* spp.) were most susceptible.

Detectable levels of damage were recorded for the first time in Algonquin Park District. Nine separate pockets of moderate-to-severe defoliation totaling 172 ha were recorded in Barron, Bronson, Dickens, Lyell, Master, Murchison and Stratton townships.

Bancroft District contained the largest area of medium-to-heavy infestation, most of which was confined to the southern part of the District, with the largest area of damage situated between Anstruther Lake and Big Cedar Lake. Parts of this same infestation also hosted large populations of the forest tent caterpillar. Smaller pockets of infestation were observed in Anstruther, Chandos and Methuen townships. The forest tent caterpillar contributed to some of the defoliation in Methuen Township. Small pockets of moderate-to-severe damage were mapped in the northern parts of the District, in Bangor and Carlow townships.

ALGONQUIN REGION

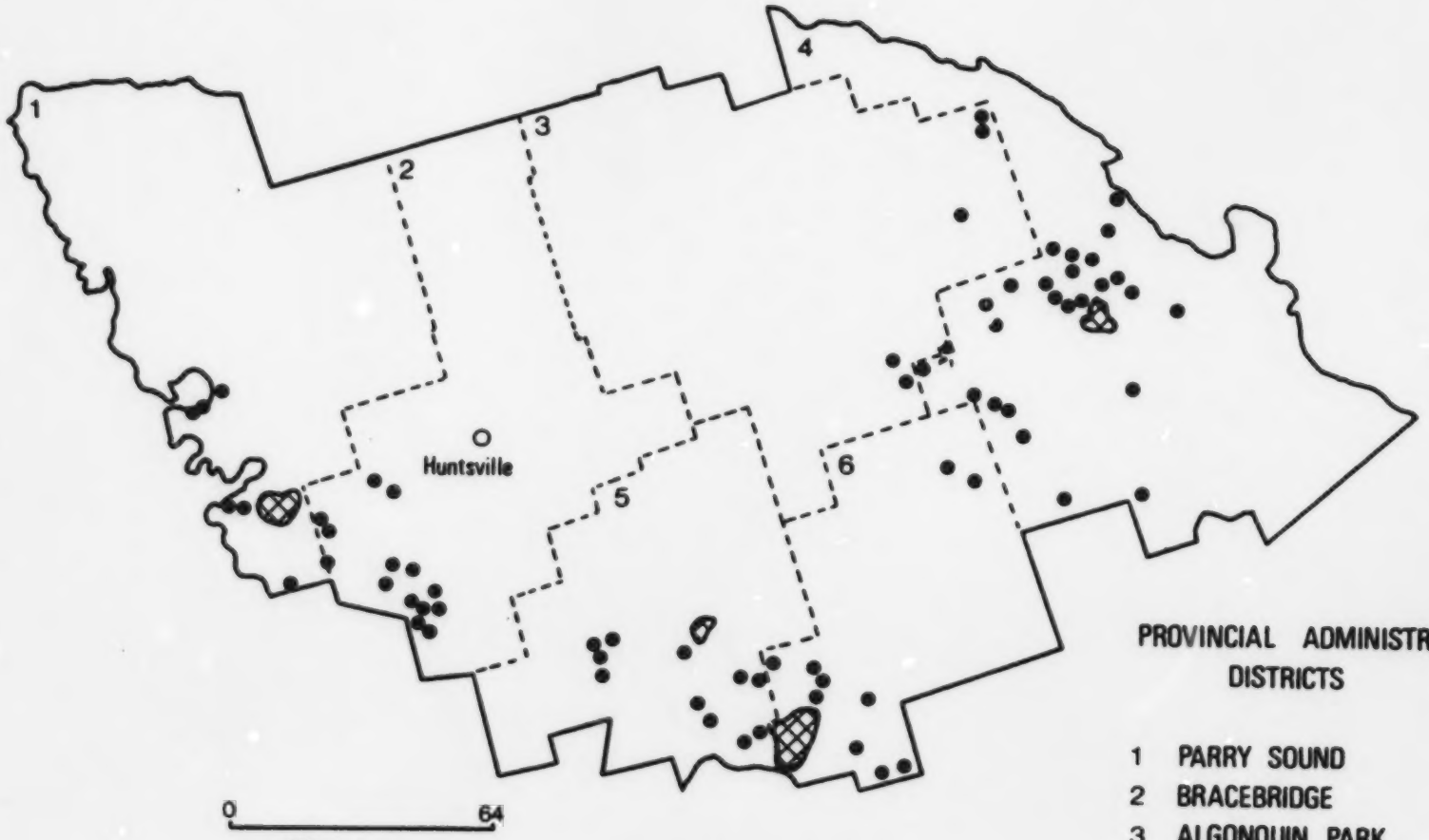


Figure 7. Gypsy moth, *Lymantria dispar* (L.)
Areas within which moderate-to-severe defoliation occurred in 1990
● or ⊠

Approximately 4,359 ha of moderate-to-severe defoliation were delineated in the southern portion of Bracebridge District, in the Lake Rosseau, Lake Muskoka and Lake Joseph areas. Most of the damage occurred south of these lakes on oak, aspen and eastern white pine on rocky outcrops. Some of the infested stands also hosted large populations of the forest tent caterpillar, complicating accurate assessment of gypsy moth populations. At one location in Wood Township, a random count of 200 larvae revealed that 61% of the larvae collected were the forest tent caterpillar. A short distance from this location, the same process indicated that 82% of the collected larvae were gypsy moth.

Surveys detected 5,051 ha of medium-to-heavy infestation in Minden District, with a large part on the western side of Gull Lake. Defoliation by gypsy moth in this area was compounded by the presence of forest tent caterpillar. A random count of larvae of both defoliators in one area indicated that 78% of the insects were the forest tent caterpillar. Another fairly extensive area of defoliation was mapped west of Bark Lake in Glamorgan and Snowdon townships. Again, damage could not be attributed solely to gypsy moth because of the presence of low-to-moderate numbers of the forest tent caterpillar. Elsewhere in Minden District, smaller pockets of moderate-to-severe defoliation were noted in Snowdon, Galway, Cavendish and Harvey townships.

Medium-to-heavy infestations totaling 9,367 ha were recorded for the first time in Parry Sound District. The largest body of damage occurred in the Moon River-MacTier area of Freeman Township, where gypsy moth was the main defoliator. A number of smaller pockets of damage occurred west of this area in Freeman and Conger townships, where gypsy moth was also the main defoliator. Two small pockets of moderate-to-severe defoliation were recorded in Gibson Township, but the presence of large numbers of the forest tent caterpillar in this area complicated the delineation of gypsy moth infestations. A large infestation by gypsy moth was mapped on Parry Island, but parts of the island also had large populations of the forest tent caterpillar. Counts of 200 randomly collected larvae at three locations on Parry Island revealed 73, 58 and 0% gypsy moth. Three small infestations were mapped in Carling Township, two of which occurred in Killbear Provincial Park. The areas infested in the park also hosted similar numbers of forest tent caterpillar.

More than 60 separate medium-to-heavy infestations, totaling 7,148 ha, were recorded in central Pembroke District. A large part of the damage occurred north of the Golden-Round lakes area in North Algona, Fraser and Richards townships. Moderate-to-severe defoliation levels were also noted in Petawawa, Alice, Wilberforce, Grattan, Griffith, Raglan, South Algona, Sebastopol, Radcliffe, Sherwood and Burns townships.

Eastern Tent Caterpillar, *Malacosoma americanum* (F.)

High population levels and accompanying moderate-to-severe defoliation of cherry (*Prunus* spp.) was once more observed in the western part of the Region in the Bracebridge, Minden and Parry Sound districts. Generally,

populations decreased and mostly small numbers of larvae were found in the remaining districts.

Surveys in Shelbourne Township, Minden District, detected as many as 12 tents per 3-m-high tree and up to 90% defoliation. Assessment of 3-m-high pin cherry (*Prunus pensylvanica* L.f) at one location in this township revealed that 66% of the roadside trees were affected and defoliation averaged 30%. Large numbers of caterpillars (typically three tents per 2-m-high tree) were observed in Muskoka and Wood townships, Bracebridge District. Complete defoliation of 1- to 2-m trees was noted at a number of locations in McMurrich and Monteith townships, Parry Sound District.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

After 4 years of population increases, the total area of medium-to-heavy infestation in 1990 decreased to 192,170 ha, an 85% reduction from the previous year (Fig. 8 and 9). Oak and aspen were the preferred hosts of the caterpillar (see Frontispiece) but moderate-to-severe defoliation of birch (*Betula* spp.) and sugar maple were also recorded.

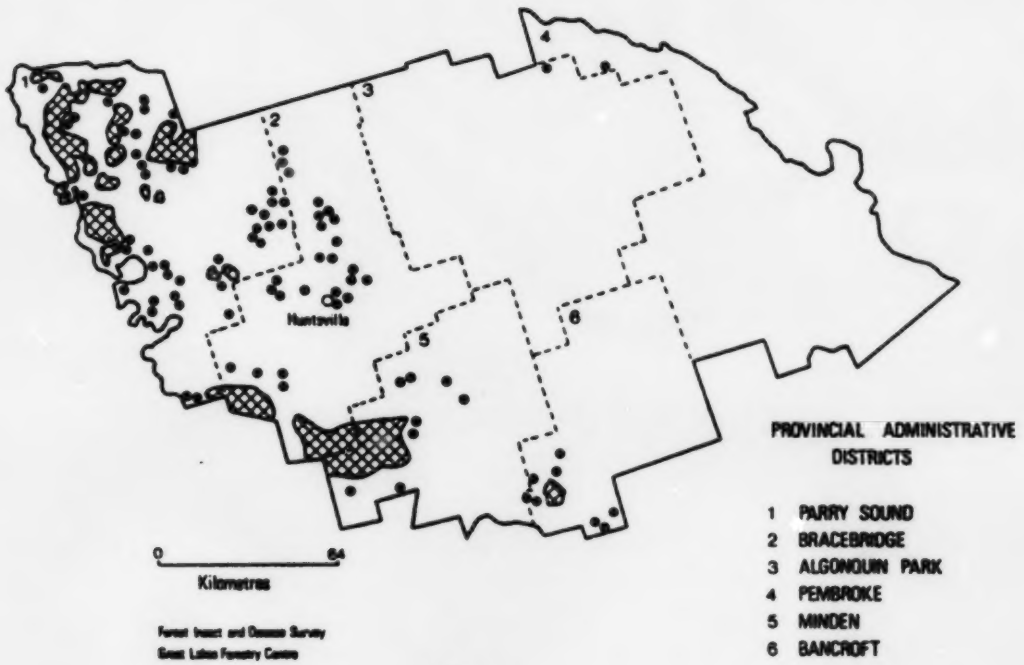
In the current outbreak, the largest populations in the Region have occurred in Parry Sound District. The forecast in 1989 was correct, with a further population reduction occurring in 1990 in much of the District; there were 102,714 ha of moderate-to-severe defoliation, down considerably from the 390,886 ha recorded in the previous year (Table 5). Damage was observed throughout the District, with small isolated pockets in the eastern part and larger, more continuous areas in the west. A large part of the defoliation occurred around the Highway 69 corridor (Fig. 10).

The previous medium-to-heavy infestation in northern Bracebridge District collapsed, leaving behind only small, remnant pockets of damage. A total of 39,106 ha of moderate-to-severe defoliation was recorded, with most of the damage occurring in the southern part of the District. Damage in this area was complicated by the presence of varying population levels of the gypsy moth.

The previous infestation in the southern part of Minden District collapsed; only small, isolated pockets of damage remained. Small, scattered areas of mostly moderate defoliation were mapped in the central part of the District. One large medium-to-heavy infestation occurred in the western part of the District in parts of Laxton, Digby, Dalton, Longford, Lutterworth, Minden and Anson townships. Parts of this area also supported populations of the gypsy moth.

The largest population collapse occurred in Algonquin Park District, in which a 99% reduction was recorded. Two pockets of moderate-to-severe defoliation totaling 330 ha were noted, one in Fitzgerald Township, the other in Lyell township.

1989



1990

Figure 8. Forest tent caterpillar,
Malacosoma disstria Hbn.
A comparison of the areas infested in 1989 and 1990
● or ⊠

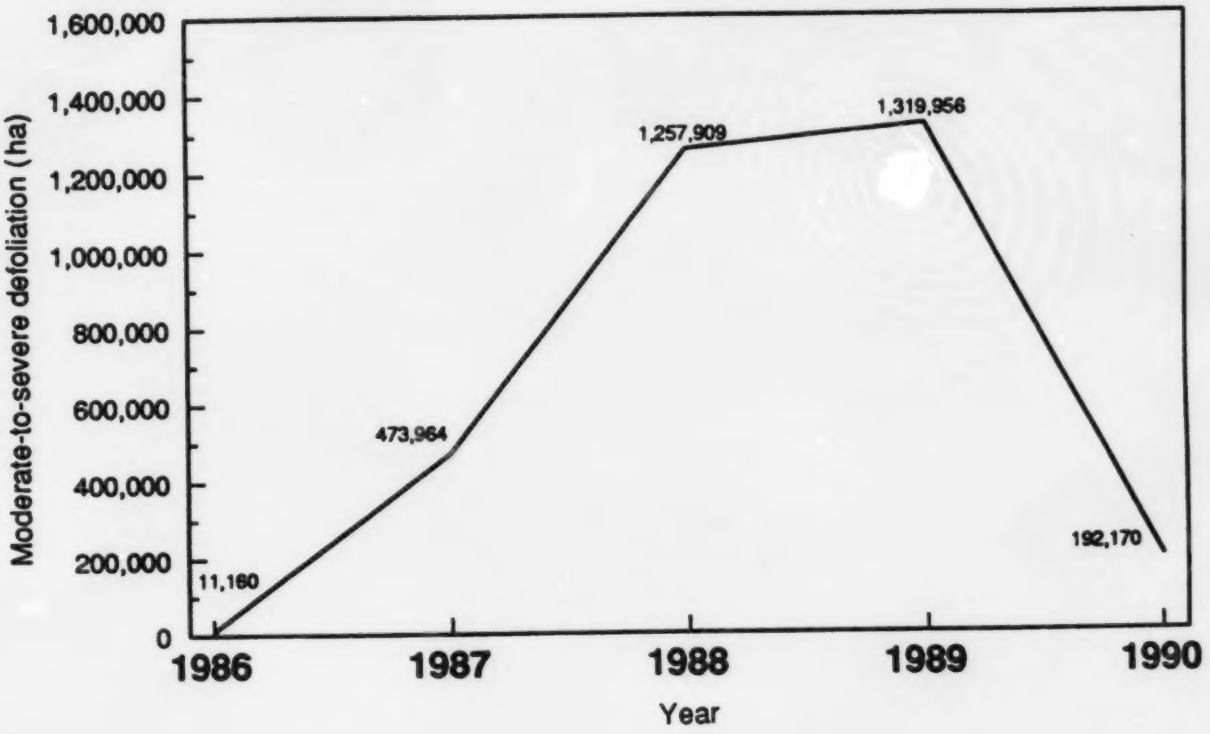


Figure 9. Area of damage caused by the forest tent caterpillar over a 5-year period in the Algonquin Region of Ontario.

Table 5. Gross area of moderate-to-severe defoliation caused by the forest tent caterpillar in 1989 and 1990 in the Algonquin Region of Ontario.

District	Area of moderate-to-severe defoliation (ha)		Change (ha)
	1989	1990	
Algonquin Park	171,988	330	-171,658
Bancroft	212,540	5,560	-206,980
Bracebridge	174,171	39,106	-135,065
Minden	267,576	49,675	-217,901
Parry Sound	390,886	102,714	-288,172
Pembroke	102,795	85	-102,710
Total	1,319,956	197,470	-1,122,486

ALGONQUIN REGION

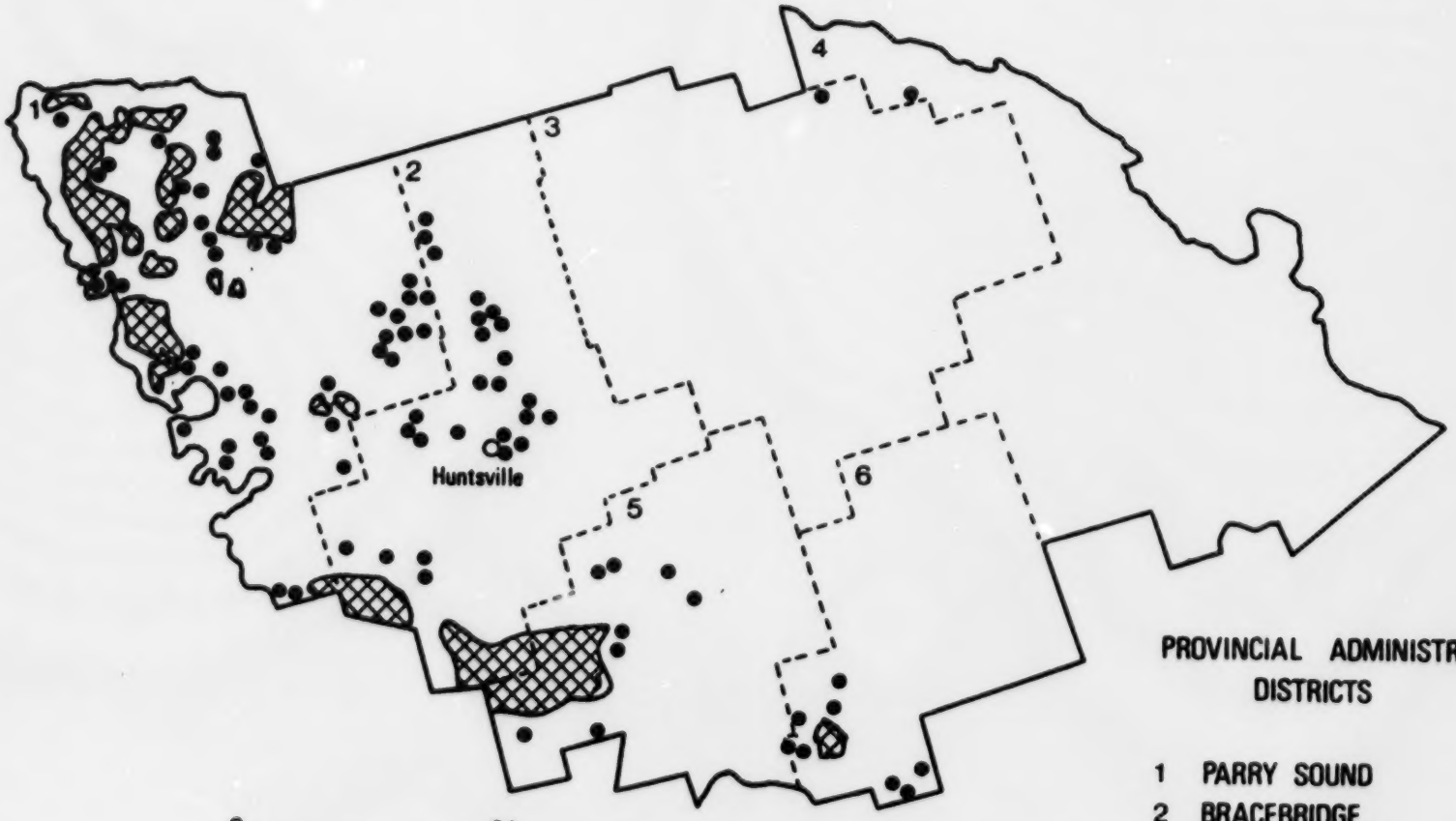


Figure 10. **Forest tent caterpillar, *Malacosoma disstria* Hbn.**
Areas within which moderate-to-severe defoliation occurred in 1990
● or ⊠

Moderate-to-severe defoliation in Bancroft District in 1990 was confined to the southwestern corner. Eight pockets totaling 5,560 ha were all that remained of the 212,540-ha infestation from the previous year. The largest area occurred in the Anstruther-Long lakes area. Gypsy moth was present in this area.

A single 85-ha pocket of medium-to-heavy infestation was the only reminder that forest tent caterpillar had occurred in large numbers in Pembroke District.

A number of factors indicate that a further break-up will occur in the area infested in part of the Region and a collapse will occur in another part (Fig. 11). Moderate-to-severe defoliation is forecast for parts of western Algonquin Region based on egg-band surveys conducted at 16 locations (Table 6). The forecast procedure that was used tends to underestimate defoliation in the early stages of an infestation and overestimate it in an aging outbreak such as is occurring in Algonquin Region. Taking into account egg parasitism, mortality of overwintering larvae, the smaller egg bands observed, the widespread presence of larval diseases such as the fungus *Furia crustosa* (MacLeod & Tyrrell) and the microsporidian *Nosema disstriae* (Thomson) in 1990, the high rate of parasitism by the "friendly fly" (*Sarcophaga aldrichi* Park.) and the history of past infestations, the following prediction can be made.

The remnant populations in the Algonquin Park, Bancroft and Pembroke districts are expected to collapse in 1991. However, pockets of medium-to-heavy infestation are expected to persist in the southwestern part of Minden District throughout the area currently infested. The infestation in southern Bracebridge District is expected to break up, leaving recurring pockets of moderate-to-severe damage. Further break-up of the infestation and reduction on the area affected is also forecast for Parry Sound District.

Redheaded Pine Sawfly, *Neodiprion lecontei* (Fitch)

Small numbers of the sawfly were recorded at a few locations in the Region. Defoliation averaging 15% was recorded on 16% of the 2.6-m trees in a 0.4-ha portion of a 5-ha red pine plantation in Cardiff Township, Bancroft District. Assessment of 2.4-m red pine in a 5-ha plantation in Ryerson Township, Parry Sound District, found that 33% of the trees were affected and defoliation averaged 7%. A survey of 2.8-m red pine in a 1.5-ha plantation in Westmeath Township, Pembroke District, revealed 12% of the trees were attacked and defoliation averaged 18%. Control operations using the Lecontevirus were carried out in a number of plantations in the Bancroft and Parry Sound districts.

ALGONQUIN REGION

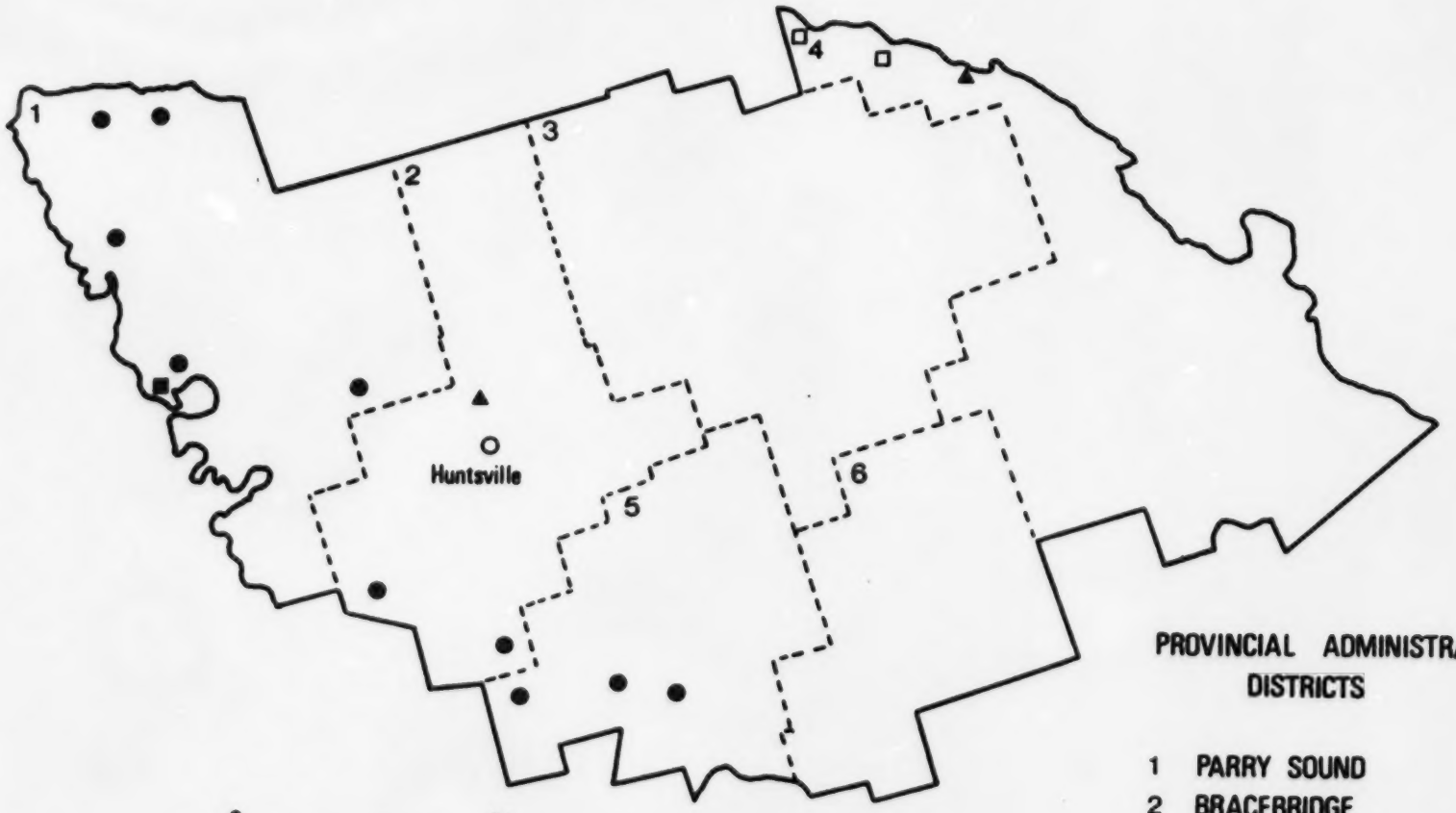


Figure 11. **Forest tent caterpillar, *Malacosoma disstria* Hbn.**
Locations of egg-band counts and defoliation forecasts for 1991

Severe ●
Moderate ■
Light ▲
Nil □

Table 6. Forest tent caterpillar egg-band counts on trembling aspen at 15 locations in the Algonquin Region of Ontario in 1990 and infestation forecasts for 1991.

Location (Twp)	Avg. DBH of sample tree (cm)	No. of trees sampled	Avg. no. of egg bands per tree	Infestation forecasts for 1991[a]
Bracebridge District				
Chaffey	9.5	3	1	L
Ryde	10.5	1	24	S
Wood	11.0	3	9	S
Minden District				
Dalton	11.5	3	8	S
Lutterworth	9.5	1	18	S
Snowdon	11.0	3	8	S
Parry Sound District				
Blair	14.0	1	21	S
Carling	13.0	3	14	S
Carling	8.5	3	5	M
Monteith	13.5	1	24	S
Mowat	9.0	3	8	S
Wallbridge	10.5	1	18	S
Pembroke District				
Clara	8.0	3	0	N
Head	9.0	3	1	L
Maria	9.0	3	0	N

[a] N = nil, L = light, M = moderate, S = severe

Yellowheaded Spruce Sawfly, *Pikonema alaskensis* (Roh.)

High population levels were noted attacking white spruce in the western part of the Region. For the most part, damage in Minden and Bracebridge districts occurred on open-growing ornamental and roadside trees 1 to 3 m in height, which sustained up to 90% defoliation of the current growth. This damage was recorded in Perry and Watt townships, Bracebridge District, and in Minden and Somerville townships, Minden District. At one location in Watt Township, assessment of 177 3-m-tall windbreak white spruce indicated that the entire sample was affected and defoliation averaged 35%. However, defoliation of 90% or more was recorded on 18% of the sample trees and 1% recent whole-tree mortality was also noted.

At one other location in the Region, in a 0.2-ha plantation in Mayo Township, Bancroft District, a survey revealed defoliation that averaged 5% on 10% of the white spruce hosts.

White Pine Weevil, *Pissodes strobi* (Peck)

Four plantations were examined to determine the incidence of leader attack. For the three plantations in Pembroke District, the results are as follows: 87% of the 0.6-m red pine in a 0.4-ha portion of a 2.2-ha plantation in Alice Township were attacked, 10% of the 2-m eastern white pine in a 1-ha plantation in Sherwood Township were damaged, and 39% of the 4.2-m eastern white pine in a 4-ha plantation in Ross Township experienced leader damage. A survey in a 2-ha plantation of 1.9-m white pine in Armour Township, Bracebridge District, revealed the incidence of weevil attack was 2%.

Minor Insects

Introduced Pine Sawfly, *Diprion similis* (Htg.)

The first record of this pest, which affects many of the pines, occurred in 1931 near Oakville. A second generation is common, and larvae can be found both in June and September. Populations are usually kept in check by natural control factors.

A slight northward extension of the range of this pest was recorded in 1990 in a 2-ha plantation of 1.9-m white pine in Armour Township, Bracebridge District. A standard pest assessment revealed that 10% of the sample was affected and associated defoliation of new and old growth was less than 5%.

Table 7. Other forest insects.

Insect	Host(s)	Remarks
Adelges abietis (L.) Eastern spruce gall adelgid	wS	Shoot mortality of 2.1-m trees in a 0.2-ha plantation in Mayo Twp, Bancroft District, averaged 15%.
Neodiprion pratti paradoxicus Ross Jack pine sawfly	jP	Defoliation averaged 60% on open-growing 10-m trees in Galway Twp, Minden District.
Neodiprion sertifer (Geoff.) European pine sawfly	mugho pine	Light-to-moderate damage was recorded in the town of Minden.

(cont'd)

Table 7. Other forest insects (concl.).

Insect	Host(s)	Remarks
Paraclemensia acerifoliella (Fitch) Maple leafcutter	sM	Defoliation averaged 80% and 100% to the 23-m overstory and regeneration, respectively, in an 8-ha portion of a 40-ha woodlot in McNab Township, Pembroke District.
Pissodes approximatus Hopk. Northern pine weevil	rP	Assessment in a 25-ha plantation of 1.9-m trees in Armour Twp, Bracebridge District disclosed a 1% incidence of attack.
Pristiphora geniculata (Htg.) Mountain-ash sawfly	aMo	Light-to-moderate damage was noted in the town of Parry Sound.
Rhychaenus rufipes (LeC.) Willow flea weevil	W	Foliar damage ranging from 40 to 90% was recorded on ornamental trees in the towns of Whitney, Madawaska, Bancroft, Deep River and Rolphton.

TREE DISEASES

Armillaria Root Rot, *Armillaria ostoyae* (Romagn.) Herink

Infections by this root-rot fungus caused recent tree mortality in 10 red pine plantations in the Bracebridge and Parry Sound districts. Trees in the affected plantations ranged in height from 1 to 2.9 m and the incidence of infection was 1% or less. The affected plantations occurred in Humphrey, McMurrich, Spence and Ryerson townships, Parry Sound District, and in Monck and Stephenson townships, Bracebridge District.

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

In all, 95 red pine plantations ranging in height from 0.2 to 9 m were surveyed in 1990 to determine the presence and distribution of the North American race and the more virulent European race of the Scleroderris canker fungus (Table 8). Serological testing confirmed the presence of the European strain of the fungus at four locations, two of which also harbored the North American race (Fig. 12). The North American race was found by itself at three locations.

Three of the four plantations in which the European race was found (one in Mayo Township, Bancroft District, and one in each of McMurrich and Ryerson townships, Parry Sound District) were in townships with a previous history of the European race of the fungus. A confirmed infection in Stephenson Township, Bracebridge District, represented a new extension in the geographic range of the European race of the fungus. This new record in Concession 3, Lot 24, of Stephenson Township occurred in a 5-ha plantation of 1.1-m-high red pine. Assessment revealed that 3% of the trees were affected and recent tree mortality was observed outside the plots. The European strain of the fungus was also found infecting 1% of the 4.5-m red pine in Concession 14, Lot 24, of Mayo Township, Bancroft District.

Both races of the fungus were found infecting 1% of the 2.4-m-tall red pine in an 18-ha planted area in Concession 5, Lots 12 and 13, of Ryerson Township, Parry Sound District. Both races were also detected in a 30-ha plantation of 1.9-m red pine in Concession 6, Lots 12 and 13, of McMurrich Township, Parry Sound District.

The North American race was recovered by itself from three red pine plantations. Surveys at all three locations determined that the incidence of infection as well as recent tree mortality caused by the fungus were less than 1%. The affected areas included a 10-ha plantation of 1.4-m trees in Concession 9, Lot 20, of McMurrich Township, Parry Sound District; in a 4-ha plantation of 2.6-m trees in Concession 4, Lot 25, of Ryerson Township, Parry Sound District; and in a 10-ha plantation of 1.2-m red pine in Concession 11, Lot 14, of Perry Township, Bracebridge District.

Table 8. Results of a special survey for Scleroderris canker at 95 locations in the Algonquin Region of Ontario in 1990 (counts based on an examination of more than 500 red pine trees at each location).

Location (Twp)	Tree height (m)	Total trees per hectare	Total area examined (ha)	Trees affected (%)	Trees dead (%)
Algonquin Park District					
Airy	0.7	1,800	3	0	0
Airy	2.3	1,800	2	0	0
Fitzgerald	0.5	1,000	1	0	0
Nightingale	0.5	1,900	5	0	0
Preston	3.5	200	5	0	0
White	0.6	1,800	3	0	0
Bancroft District					
Burleigh	8.5	1,700	3	0	0
Burleigh	3.0	2,200	4	0	0
Cardiff	2.6	2,000	5	0	0
Dungannon	4.0	2,100	4	0	0
Dungannon	5.0	2,100	3	0	0
Herschel	5.0	1,800	1	0	0
Herschel	4.0	2,000	2	0	0
Mayo	1.0	2,000	2	0	0
Mayo	9.0	2,200	2	0	0
Mayo	4.5	2,000	0.2	1	0[b]
Mayo	2.0	2,200	9	0	0
Mayo	4.5	1,500	5	0	0
Mayo	0.7	1,800	6	0	0
Mayo	0.2	1,800	2	0	0
Mayo	0.8	2,000	4	0	0
Mayo	5.0	2,000	1	0	0
Mayo	1.9	2,000	3	0	0
Mayo	5.0	2,000	1	0	0
Mayo	4.0	2,000	2	0	0
Monteagle	0.5	2,000	7	0	0
Monteagle	3.0	1,800	3	0	0
Monteagle	3.0	2,200	4	0	0
Bracebridge District					
Joly	1.8	2,500	5	0	0
Monck	1.2	1,800	5	0	0
Perry	1.2	2,900	10	<1	<1[a]
Stephenson	1.1	2,200	5	3	<1[b]
Strong	1.5	2,500	5	0	0
Watt	1.2	1,600	5	0	0

(cont'd)

Table 8. Results of a special survey for Scleroderris canker at 95 locations in the Algonquin Region of Ontario in 1990 (counts based on an examination of more than 500 red pine trees at each location) (cont'd).

Location (Twp)	Tree height (m)	Total trees per hectare	Total area examined (ha)	Trees affected (%)	Trees dead (%)
Minden District					
Galway	1.9	2,000	8	0	0
Harburn	2.5	1,900	10	0	0
Snowdon	2.7	2,200	8	0	0
Snowdon	0.7	1,800	6	0	0
Somerville	1.8	2,700	10	0	0
Somerville	2.5	2,500	10	0	0
Parry Sound District					
Carling	2.2	2,500	8	0	0
Chapman	1.6	2,200	3	0	0
Christie	0.7	2,000	5	0	0
Christie	0.9	2,300	5	0	0
Foley	0.6	2,000	3	0	0
Humphrey	2.3	2,000	8	0	0
Humphrey	3.1	2,000	10	0	0
McDougall	3.1	2,500	10	0	0
McDougall	0.7	2,100	5	0	0
McDougall	2.0	2,500	2	0	0
McMurrich	1.4	2,500	3	0	0
McMurrich	1.4	2,200	10	<1	<1[a]
McMurrich	3.3	1,600	2	0	0
McMurrich	1.0	1,900	10	0	0
McMurrich	2.2	2,500	8	0	0
McMurrich	2.0	2,500	2	0	0
McMurrich	1.9	1,600	30	<1	<1[c]
McMurrich	0.5	2,000	10	0	0
McMurrich	1.3	2,300	5	0	0
Ryerson	2.4	2,500	18	1	0[c]
Ryerson	1.1	2,500	10	0	0
Ryerson	1.1	2,400	10	0	0
Ryerson	2.6	2,500	15	<1	<1[a]
Spence	2.9	1,500	2	0	0

(cont'd)

Table 8. Results of a special survey for Scleroderris canker at 95 locations in the Algonquin Region of Ontario in 1990 (counts based on an examination of more than 500 red pine trees at each location) (concl.).

Location (Twp)	Tree height (m)	Total trees per hectare	Total area examined (ha)	Trees affected (%)	Trees dead (%)
Pembroke District					
Alice	1.9	2,000	1	0	0
Alice	3.8	2,000	0.2	0	0
Adamston	5.5	1,800	3	0	0
Bromely	3.5	2,000	10	0	0
Brougham	1.9	2,000	4	0	0
Buchanan	1.0	2,000	6	0	0
Fraser	0.7	2,100	2	0	0
Fraser	0.7	1,200	2	0	0
Fraser	1.7	2,000	2	0	0
Griffith	1.0	2,500	6	0	0
Hagarty	5.5	1,700	8	0	0
Hagarty	1.0	2,000	10	0	0
Head	1.5	1,800	3	0	0
Horton	0.4	2,000	7	0	0
Horton	2.0	2,000	6	0	0
Horton	2.4	2,200	20	0	0
Maria	5.5	2,100	4	0	0
McNab	2.8	1,200	1	0	0
Radcliffe	4.2	2,200	4	0	0
Raglan	3.0	2,500	4	0	0
Raglan	9.0	2,500	5	0	0
Ross	4.5	2,200	10	0	0
Ross	2.5	2,000	20	0	0
Sebastopol	2.5	2,000	6	0	0
Sebastopol	5.5	1,800	4	0	0
Sherwood	1.0	2,000	3	0	0
Westmeath	6.0	2,200	10	0	0
Westmeath	3.0	2,200	4	0	0
Wilberforce	1.8	2,000	15	0	0
Wilberforce	4.0	2,200	15	0	0
Wilberforce	1.0	2,000	7	0	0

[a] North American race only
[b] European race only
[c] North American and European strains

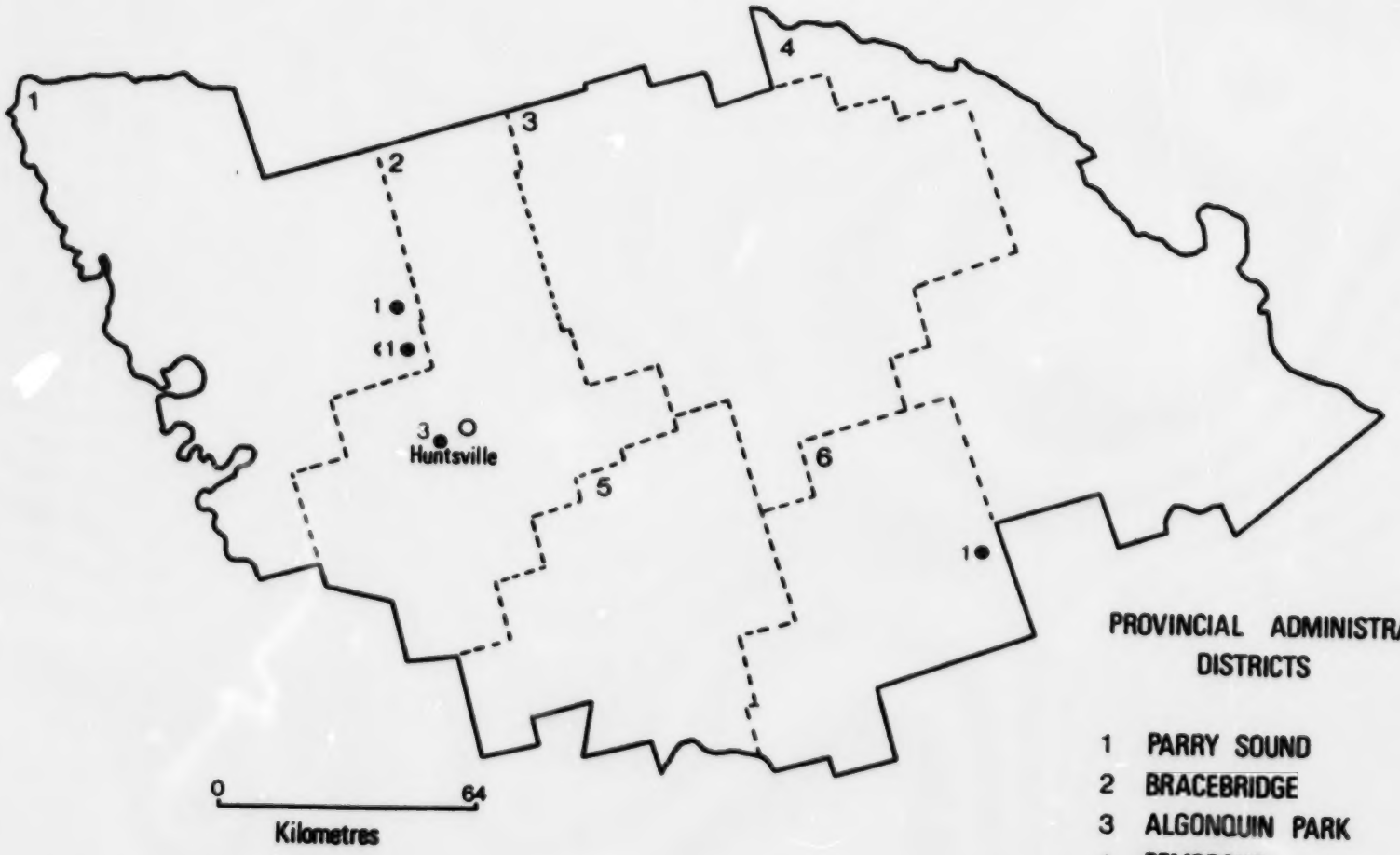


Figure 12. **Sclerroderris canker,**
***Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard**
Locations of infection centers of the European race of the disease and proportion of trees affected (number beside location, in %) ●

Table 9. Other forest diseases.

Organism	Host(s)	Remarks
Cronartium ribicola J.C. Fisher White pine blister rust	wP	The incidence of infection averaged 2%, with 1.3% branch infection and 0.7% stem infection, in a 2-ha plantation of 1.9-m trees in Armour Twp, Bracebridge District.
Oxyporus populinus (Schumacher:Fr.) Donk White spongy rot	sM	Fruiting was observed in natural stands of the host in Chaffey and Machar twps, Bracebridge District, Minden and Monmouth twps, Minden District, and Carling Twp, Parry Sound District.

ABIOTIC DAMAGE

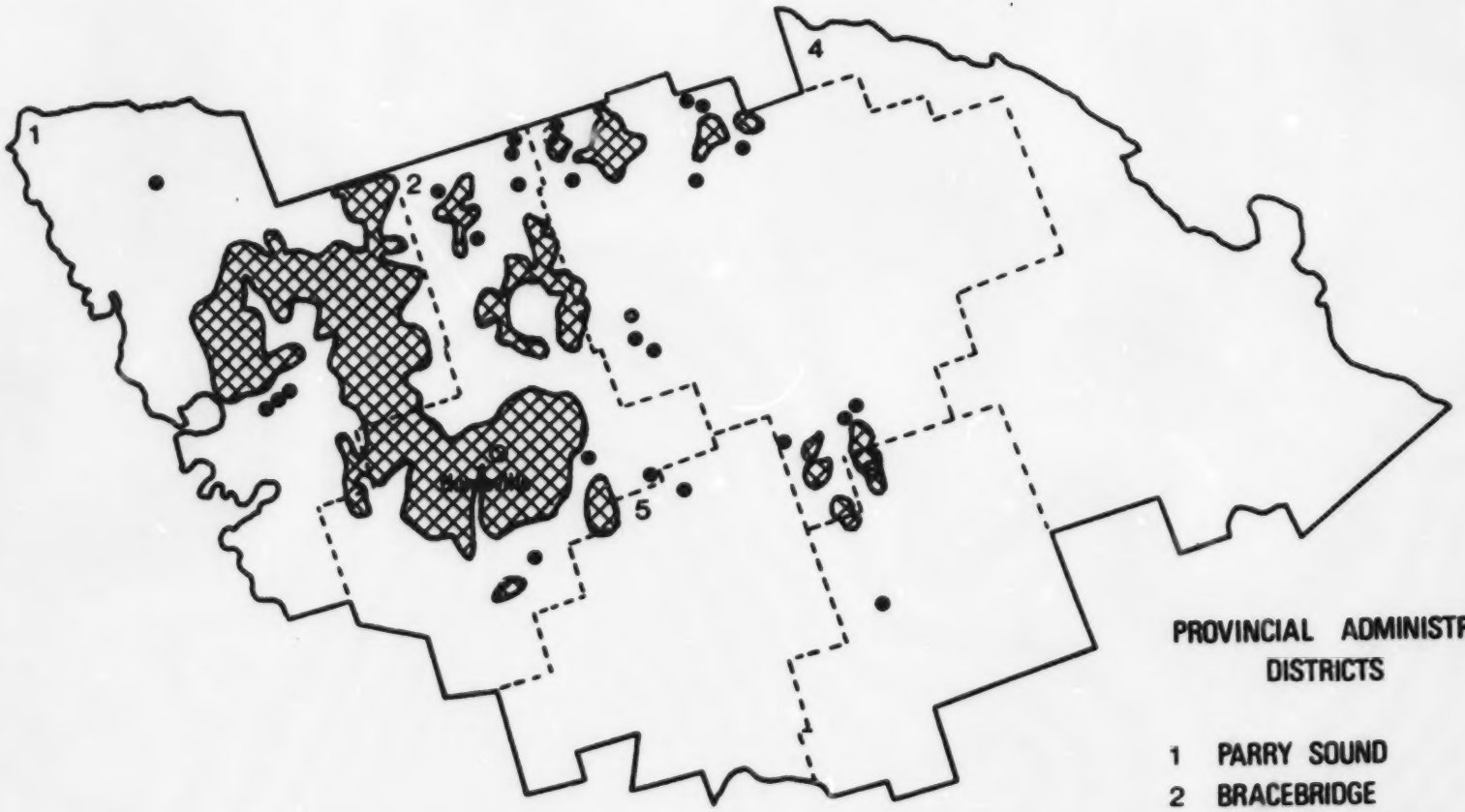
Foliar Discoloration, Dieback and Tree Mortality

Three successive years of below-normal precipitation and medium-to-heavy infestations by the forest tent caterpillar have had a noticeable detrimental effect on forest health in the Region. Symptoms of the resultant stress have taken the form of premature foliar discoloration and leaf-fall of hardwoods, leaf scorch and dwarfed foliage of hardwoods, and branch and tree mortality (Fig. 13).

Extensive areas (336,379 ha) of foliar discoloration caused by a combination of leaf scorch, dwarfed foliage, premature foliar discoloration and light dieback were mapped throughout the Region. Table 14 and Figure 14 give a breakdown of the affected area by district. The largest areas of discoloration occurred in the western part of the Region in the Parry Sound and Bracebridge districts, with smaller areas of damage in the rest of the Region. The tree species most affected by this complex of abiotic factors were sugar maple, yellow birch and beech. Within affected stands, leaf scorch was confined to the exposed upper crowns of the dominant and co-dominant trees. Open-growing trees or those on the edge of stands experienced up to 100% foliar damage.

In all, 16,060 ha of moderate-to-severe dieback and/or tree mortality of conifers and hardwoods (mainly hardwoods) was recorded in the Region. With coniferous species such as eastern white pine, eastern hemlock (*Tsuga canadensis* [L.] Carr.) and balsam fir, damage manifested itself mostly as single-tree mortality within stands; for the most part, this was not included

ALGONQUIN REGION



PROVINCIAL ADMINISTRATIVE DISTRICTS

1 PARRY SOUND
2 BRACEBRIDGE
3 ALGONQUIN PARK
4 PEMBROKE
5 MINDEN
6 BANCROFT

Forest Insect and Disease Survey
Great Lakes Forestry Centre

Figure 13. Areas within which abnormal foliage occurred as a result of leaf scorch, premature leaf discoloration, and dwarf foliage in 1990

● or ⊠

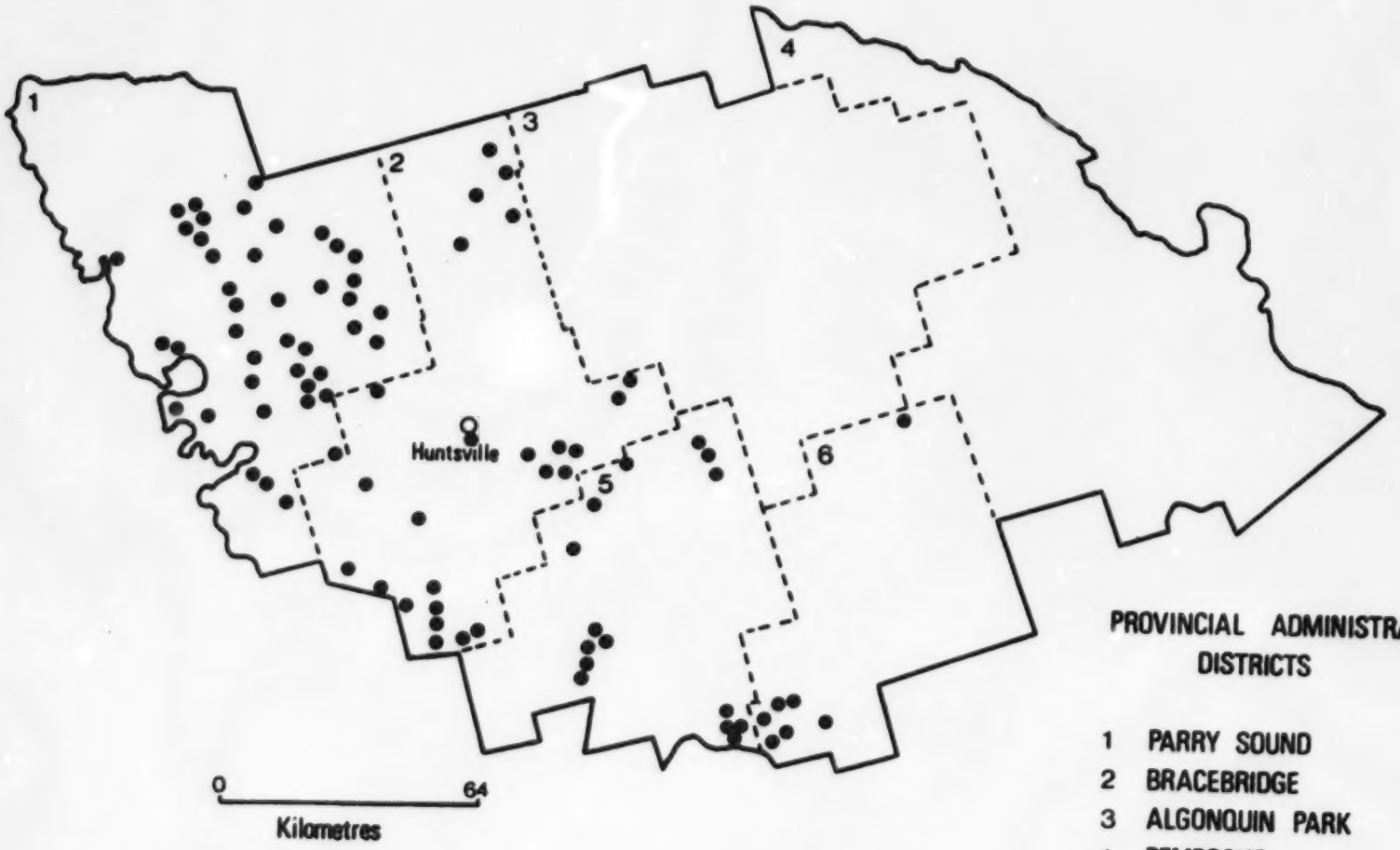
in the total area of damage because it was so widespread. A 100-tree mortality cruise in a stand of eastern hemlock averaging 18.0 m in height and 41.0 cm DBH in Hindon Township, Minden District, revealed 2% recent tree mortality. Branch mortality of 10-20% within the living crowns of a number of trees was also noted. Surveys also recorded single-tree mortality of mature eastern white pine on shallow soils and an increase in single-tree mortality of balsam fir. Current single-tree mortality of jack pine was also recorded along the Georgian Bay coast in Harrison, Carling, Shawanaga and Wallbridge townships, Parry Sound District. A 100-tree mortality cruise in Wallbridge Township disclosed 1% recent tree mortality (in addition to 12% old mortality) in an area currently infested with the jack pine budworm but that had also been infested by this same pest from 1982 to 1986.

The gross area of premature foliar discoloration, dieback and whole-tree mortality encountered in the Algonquin Region of Ontario in 1990 is as follows:

District	Premature foliar discoloration (ha)	Moderate-to-severe dieback and tree mortality (ha)
Algonquin Park	38,781	0
Bancroft	11,600	1,398
Bracebridge	137,778	5,896
Minden	1,400	3,146
Parry Sound	146,820	5,620
Pembroke	0	0

Moderate-to-severe dieback and tree mortality of white birch, yellow birch (*Betula papyrifera* Marsh.), trembling aspen (*Populus tremuloides* Michx.), largetooth aspen (*Populus grandidentata* Michx.), sugar maple, beech, red oak (*Quercus rubra* L.) and white oak (*Quercus alba* L.) was widespread in areas of shallow soils, and especially noticeable in areas that had also hosted large numbers of forest tent caterpillar (Fig. 14). The incidence of tree mortality was generally light, estimated at less than 5% for most tree species; an exception was oak, especially red oak. The largest single area (2000 ha) of oak decline and tree mortality was recorded in the Mississauga Lake area of Minden District. A 50-tree count of both red oak and white oak disclosed 42 dead trees (84% mortality of the oak component). The two tree species were surveyed because a large component of red oak in the affected area was dead. A 25-tree dieback assessment of both oak species (18 white oak, 7 red oak) disclosed that 14 trees (56% of the sample) had greater than 41% total cumulative dieback. Oak mortality was also observed in other locations in Minden District, such as the Gull Lake area and in Sherbourne and Stanhope townships. A 100-tree mortality cruise of red oak averaging 25 m tall and 38 cm DBH was carried out in a recently logged area in Stanhope Township. The survey disclosed that 55% of the remaining red oak were dead.

ALGONQUIN REGION



Forest Insect and Disease Survey
Great Lakes Forestry Centre

Figure 14. Areas within which moderate-to-severe decline and/or tree mortality occurred in 1990 ●

In Bracebridge District, areas of severe oak deterioration and tree mortality were recorded in the Muldrew-Kashe lakes area. A number of similar areas were recorded in the Moon River area of Parry Sound District, north along the coast of Georgian Bay, as well as in the central part of the district in oak stands on shallow, rocky sites.

Another large area of severe oak decline and tree mortality was the Anstruther-Gold lakes area of Bancroft District. A 100-tree mortality cruise of red oak at one location in this area revealed that 36% of the trees were dead. The installation of a 25-tree dieback plot revealed that four trees (16%) had >41% cumulative dieback.

Branch and whole-tree mortality of aspen, especially largetooth aspen, occurred in the Region. In a number of areas in Minden District, largetooth aspen failed to flush a set of leaves or had only a few branches with foliage. These areas had previously sustained high population levels of the forest tent caterpillar.

The combined effect of site, drought and insect infestations was also reflected in some of the 25-tree maple health plots established in 1987 (see below). Of the 20 plots, nine had five or more trees with more than 21% total dieback, and eight trees have died since the plots were established.

Frost Damage

Above-normal temperatures in late April precipitated the flushing of leaves of some hardwood species, mostly oak and sugar maple, but cool temperatures and accompanying frosts damaged the developing foliage of these trees. For the most part, affected foliage developed a bronze or reddish tinge similar to fall colors. Partial- and whole-leaf mortality was also recorded throughout the Region; the affected foliage turned dark and fell from the tree.

A stand of 15-m sugar maple in Somerville Township, Minden District, that exhibited typical foliar discoloration was assessed. Up to 100% of the foliage of the overstory trees was discolored, but the average was 60% on most trees. As much as 10% of the sugar maple foliage, typically blackened, was killed. Ground surveys of sugar maple in Cavendish Township, Minden District, disclosed similar levels of foliar discoloration, with 10% leaf mortality.

Injury from Road Salt

This problem was common wherever suseptible tree species such as red pine, eastern white pine and eastern white cedar (*Thuja occidentalis* L.) could be found in close proximity to heavily traveled routes on which de-icing salt was used. Two surveys done in early spring typify the effect of road salt on roadside red pine. A 100-tree survey of 10-m red pine planted along Highway 599, Carling Township, Parry Sound District, revealed that 44% of the trees were damaged and foliar discoloration ranged from 10 to 90%,

with an overall average of 40%. Examination of a 1-ha roadside planting of 17.5-m red pine in Richards Township, Pembroke District, revealed that 70% of the trees were affected, with foliar discoloration ranging from 30 to 100%. However, buds were not damaged at either location and the production of new foliage tended to mask the orange-red discoloration later in the summer.

Wind Damage

A standard 150-tree assessment of 23-m red pine in a 20-ha plantation in Horton Township, Pembroke District, revealed that 13% of the trees experienced broken leaders as a result of high winds.

Winter Browning

Three plantations in Pembroke District that exhibited signs of winter browning were examined, and the following results were recorded: 100% of the 2.3-m red pine in an 8-ha plantation in Head Township experienced an average of 38% foliar damage; 92% of the 1-m Scots pine (*Pinus sylvestris* L.) in a 6-ha plantation in Rolph Township experienced 30% average foliar damage; and foliar damage ranged from 10 to 100% on 84% of the 14-m red pine in a 5-ha plantation in Petawawa Township.

FOREST HEALTH

Acid Rain National Early Warning System (ARNEWS)

The six ARNEWS plots in the Region are part of a nationwide network of monitoring plots established to detect changes in forest trees, ground vegetation and soil. The plots cover conditions in a variety of stand types. The plot in Sproule Township, Algonquin Park District, consists primarily of red oak; the two plots in Wylie Township, Pembroke District, are in plantations of immature white spruce and Norway spruce (*Picea abies* [L.] Karst.); the Ridout Township plot, Bracebridge District, consists of mature sugar maple and yellow birch; the plot in Sherbourne Township, Minden District, is in a mature stand of sugar maple and eastern white pine; and the plot in Mowat Township, Parry Sound District, is in a mixed stand of immature white birch, red maple (*Acer rubrum* L.) and trembling aspen. Certain information, such as branch and crown condition, current insect-or-disease-related defoliation, woody-tissue damage, and the occurrence of acid rain symptoms, is collected annually. Ground vegetation is also examined, as certain ground plants are sensitive indicators of changes in soil acidity. In 1990, a more intensive type of assessment done every 5 years, similar to that which was done when the plot was established, was carried out. There were no visible signs of damage by airborne pollutants in any of the plots. However, an average of 20% defoliation by the forest tent caterpillar was encountered in the Mowat Township plot in Parry Sound District.

Maple Health

Twenty plots, each comprising 25 semimature or mature sugar maple trees, were randomly established in 1987 to monitor tree heath in stands with a heavy sugar maple content. The crown condition of each tree was rated with a dieback classification that evaluated current and total dieback in five categories: 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = >60%, and 5 = dead tree (Table 10).

Table 10. A 4-year summary of maple health data from 20 plots established in 1987 in the Algonquin Region of Ontario (counts based on an examination of 25 sugar maple trees at each location).

Location (Twp)	Avg. DBH (cm)	Year	Current dieback[a]						Cumulative dieback[a]						Trees blown down or cut
			0	1	2	3	4	5	0	1	2	3	4	5	
			No. of trees												
Algonquin Park District															
Deacon	32.5	1987	14	11	0	0	0	0	0	3	18	4	0	0	0
		1988	23	1	0	1	0	0	0	3	16	6	0	0	0
		1989	25	0	0	0	0	0	0	16	8	1	0	0	0
		1990	22	3	0	0	0	0	0	13	12	0	0	0	0
Peck	36.3	1987	15	10	0	0	0	0	0	4	17	4	0	0	0
		1988	21	4	0	0	0	0	0	5	16	4	0	0	0
		1989	7	17	1	0	0	0	0	13	11	1	0	0	0
		1990	23	1	0	0	0	1	0	20	3	0	1	1	0
Murchison	41.0	1987	17	8	0	0	0	0	0	9	16	6	0	0	0
		1988	18	7	0	0	0	0	0	9	16	0	0	0	0
		1989	25	0	0	0	0	0	0	21	4	0	0	0	0
		1990	24	1	0	0	0	0	0	23	2	0	0	0	0
Bancroft District															
Bangor	44.9	1987	13	12	0	0	0	0	0	6	13	6	0	0	0
		1988	23	2	0	0	0	0	0	6	13	6	0	0	0
		1989	15	9	0	0	0	0	0	16	6	1	1	0	1
		1990	23	0	0	0	0	0	0	17	5	1	0	1	1
Cardiff	32.3	1987	11	12	2	0	0	0	0	3	13	9	0	0	0
		1988	22	3	0	0	0	0	0	3	15	7	0	0	0
		1989	17	8	0	0	0	0	1	18	4	1	0	1	0
		1990	21	3	0	0	0	1	1	21	1	1	0	1	0
Limerick	31.8	1987	21	4	0	0	0	0	0	6	16	3	0	0	0
		1988	24	1	0	0	0	0	0	6	16	3	0	0	0
		1989	25	0	0	0	0	0	0	19	6	0	0	0	0
		1990	24	1	0	0	0	0	0	21	4	0	0	0	0

(cont'd)

Table 10. A 4-year summary of maple health data from 20 plots established in 1987 in the Algonquin Region of Ontario (counts based on an examination of 25 sugar maple trees at each location) (cont'd).

Location (Twp)	Avg. DBH (cm)	Year	Current dieback[a] (No. of trees) 0	1	2	3	4	5	Cumulative dieback[a] (No. of trees) 0	1	2	3	4	5	Trees blown down or cut
Bracebridge District															
Chaffey	31.6	1987	24	0	0	1	0	0	14	10	0	0	1	0	0
		1988	21	3	1	0	0	0	11	12	1	0	1	0	0
		1989	19	3	1	0	1	1	16	6	1	0	1	1	0
		1990	14	8	0	1	0	2	11	11	0	0	1	2	0
Machar	34.4	1987	24	1	0	0	0	0	12	11	2	0	0	0	0
		1988	19	5	1	0	0	0	9	13	3	0	0	0	0
		1989	5	15	5	0	0	0	3	17	5	0	0	0	0
		1990	7	13	4	0	0	1	0	18	5	1	0	1	0
Stisted	29.9	1987	16	9	0	0	0	0	10	15	0	0	0	0	0
		1988	4	10	9	2	0	0	2	12	9	2	0	0	0
		1989	2	17	5	0	1	0	1	16	6	1	1	0	0
		1990	3	19	3	0	0	0	0	16	8	1	0	0	0
Wood	31.3	1987	24	1	0	0	0	0	17	7	1	0	0	0	0
		1988	17	5	3	0	0	0	14	8	3	0	0	0	0
		1989	17	7	0	0	0	1	15	8	0	0	1	1	0
		1990	18	6	0	0	0	1	16	7	0	0	1	1	0
Minden District															
Hindon	35.9	1987	24	1	0	0	0	0	9	16	0	0	0	0	0
		1988	13	11	1	0	0	0	7	17	1	0	0	0	0
		1989	14	11	0	0	0	0	11	12	2	0	0	0	0
		1990	13	12	0	0	0	0	9	11	5	0	0	0	0
Minden	41.0	1987	6	11	5	3	0	0	5	12	5	3	0	0	0
		1988	20	4	1	0	0	0	5	15	4	1	0	0	0
		1989	9	16	0	0	0	0	8	16	1	0	0	0	0
		1990	19	6	0	0	0	0	11	13	1	0	0	0	0
Monmouth	30.4	1987	21	4	0	0	0	0	12	11	2	0	0	0	0
		1988	14	8	3	0	0	0	9	12	4	0	0	0	0
		1989	8	13	3	0	0	1	7	12	3	2	0	1	0
		1990	8	12	2	0	0	3	4	13	3	2	0	3	0
Pembroke District															
Richards	40.5	1987	16	9	0	0	0	0	0	10	15	0	0	0	0
		1988	22	3	0	0	0	0	0	7	17	1	0	0	0
		1989	14	11	0	0	0	0	0	16	9	0	0	0	0
		1990	23	2	0	0	0	0	0	20	5	0	0	0	0

(cont'd)

Table 10. A 4-year summary of maple health data from 20 plots established in 1987 in the Algonquin Region of Ontario (counts based on an examination of 25 sugar maple trees at each location) (concl.).

Location (Twp)	Avg. DBH (cm)	Year	Current dieback[a]						Cumulative dieback[a]						Trees blown down or cut
			0	1	2	3	4	5	0	1	2	3	4	5	
			No. of trees												
Pembroke District (concl.)															
Ross	43.5	1987	13	12	0	0	0	0	0	12	13	0	0	0	0
		1988	18	7	0	0	0	0	0	11	14	0	0	0	0
		1989	19	5	0	0	0	0	0	18	6	0	0	0	0
		1990	19	2	0	0	0	1	0	19	1	1	0	1	2
Sebastopol	40.2	1987	18	7	0	0	0	0	0	15	9	1	0	0	0
		1988	22	3	0	0	0	0	0	15	9	1	0	0	0
		1989	23	2	0	0	0	0	0	23	1	1	0	0	0
		1990	23	2	0	0	0	0	0	21	3	1	0	0	0
Wylie	37.0	1987	23	2	0	0	0	0	0	5	17	3	0	0	0
		1988	15	9	1	0	0	0	0	4	14	7	0	0	0
		1989	20	5	0	0	0	0	0	15	7	3	0	0	0
		1990	25	0	0	0	0	0	0	17	6	2	0	0	0
Parry Sound District															
Carling	30.6	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
		1988	24	1	0	0	0	0	24	1	0	0	0	0	0
		1989	22	3	0	0	0	0	21	4	0	0	0	0	0
		1990	22	3	0	0	0	0	20	4	1	0	0	0	0
Christie	31.7	1987	8	10	7	0	0	0	3	14	7	1	0	0	0
		1988	12	11	2	0	0	0	2	16	6	1	0	0	0
		1989	5	17	3	0	0	0	1	13	11	0	0	0	0
		1990	7	17	1	0	0	0	1	19	5	0	0	0	0
Gibson	27.1	1987	22	3	0	0	0	0	15	8	2	0	0	0	0
		1988	22	3	0	0	0	0	16	8	1	0	0	0	0
		1989	20	5	0	0	0	0	18	6	1	0	0	0	0
		1990	20	5	0	0	0	0	18	6	1	0	0	0	0

[a] Dieback classes: 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = >60%, 5 = tree dead.

Table 10 indicates that, over all, 95% of the sugar maple had 20% or less current dieback, 83% of the trees had 20% or less cumulative dieback, and 1% of the living trees had >40% total crown dieback. Since plot establishment, eight trees have died.

As well as crown dieback, other variables were recorded at the 20 plots in natural stands. Defoliation by the forest tent caterpillar averaged 15% in 45% of the plots. Defoliation by the saddled prominent averaged 10% in two plots in Minden District. Maple webworm (*Tetralopha asperatella* [Clem.]) caused 5% defoliation in one plot in Minden District. Stem decay, including fruiting bodies, was observed on 5% of the plot trees. Stem cankers were recorded on 1% of the trees and damage characteristic of the sugar maple borer (*Glycobius speciosus* [Say]) was noted on 3% of the plot trees. Injury of the main stem, including such things as seams, frost cracks, and open and closed wounds, was found on 45% of the survey trees.

Nine additional plots have been established since 1989 to assess crown dieback of semimature or mature ornamental sugar maple in the Region. Five of the plots were located in urban areas, one each in Arnprior, Beachburg, Eganville, Pembroke and Renfrew. The other four plots consisted of roadside plantings (Table 11). In the five "urban" plots, 98% of the trees had 20% or less current dieback and 86% of the trees had 20% or less total dieback. Table 11 shows that all roadside trees had 20% or less current dieback and 97% had 20% or less total dieback.

Other problems in the nine plots were recorded as encountered. Fungal fruiting bodies, indicators of stem decay, were noted on 3% of the trees and cankers were recorded on 1%. Stem damage in the form of seams, frost cracks, etc. was found on 48% of the trees.

North American Maple Project (NAMP)

As outlined in the 1988 Algonquin Region report, a cooperative project was initiated by the United States Forest Service and Forestry Canada to study the health of sugar maple, with the following objectives:

1) to determine the rate of change in sugar maple tree-condition ratings from 1988 through 1990;

2) to determine if the rate of change in sugar maple tree-condition ratings differed between:
   a) various levels of pollution, measured as wet deposition;
   b) sugar bush and undisturbed forest, and
   c) various levels of initial stand conditions;

3) to determine the possible causes of sugar maple decline and the geographical relationship between the causes and extent of decline. In all, 106 plots were established in the northeastern United States; in Canada, 60 plots were set up in Quebec, Newfoundland, New Brunswick and Nova Scotia.

Ontario was responsible for 24 plots, which were paired in each deposition zone: one was in an undisturbed stand and one in a bush being tapped for maple syrup production. Four plots were in Algonquin Region, one each in Cardiff and Wicklow townships, Bancroft District, and in Ridout and Franklin townships, Bracebridge District.

Table 11. A 2-year summary of maple health data from five "urban" and four rural roadside plots established in the Algonquin Region of Ontario (counts based on an examination of 25 sugar maple trees at each location).

Location	Plot type	Avg. DBH (cm)	Year	Current dieback[a]						Cumulative dieback[a]					
				0	1	2	3	4	5	0	1	2	3	4	5
				No. of trees											
Bancroft District															
Dungannon Twp	rural	67.7	1989	25	0	0	0	0	0	23	2	0	0	0	0
			1990	18	7	0	0	0	0	16	9	0	0	0	0
Minden District															
Somerville Twp	rural	49.4	1989	13	11	1	0	0	0	7	16	2	0	0	0
			1990	17	8	0	0	0	0	7	15	3	0	0	0
Pembroke District															
Pembroke	urban	63.2	1989	25	0	0	0	0	0	21	2	1	1	0	0
			1990	18	7	0	0	0	0	16	7	1	1	0	0
Eganville	urban	54.3	1989	7	12	1	0	0	0	1	11	7	1	0	0
			1990[b]	16	7	2	0	0	0	1	13	7	3	1	0
Ross Twp	rural	67.1	1989	25	0	0	0	0	0	21	4	0	0	0	0
			1990	11	14	0	0	0	0	9	14	2	0	0	0
Westmeath Twp	rural	58.3	1989	25	0	0	0	0	0	20	5	0	0	0	0
			1990	6	19	0	0	0	0	5	15	4	1	0	0
Arnprior	urban	54.8	1990	12	13	0	0	0	0	12	9	4	0	0	0
Beachburg	urban	65.6	1990	16	9	0	0	0	0	16	6	3	0	0	0
Renfrew	urban	62.4	1990	11	14	0	0	0	0	8	16	1	0	0	0

[a] Dieback classes: 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = >60%, 5 = tree dead.
[b] Five trees added to bring the total to 25.

Although sugar maple was the primary species of interest, all trees in the plot were examined and the following quantitative and qualitative information was recorded for each: DBH, vigor (five ratings), crown condition, tapping status (sugar maple only), bole quality (hardwoods only), location of bole defects, type of bole injury, percentage of crown dieback (hardwoods), foliage transparency (hardwoods), foliar discoloration (hardwoods), dwarfed foliage (hardwoods), and defoliation (hardwoods). This

information was obtained by at least two FIDS rangers. Table 12 compares the results of the three assessments. There was very little change, except for seven new dead trees, two in the Cardiff Township plot, three in the Ridout Township plot and two in the plot in Franklin Township. The plots are relatively healthy considering the stresses that trees in the Region have had to contend with; the current survey indicates that >80% of the sugar maple in all four plots had 15% or less cumulative dieback in 1990.

Oak Health

The three red oak plots established in 1977 to monitor changes in crown condition, one in Macaulay Township, Bracebridge District, and one in each of Alice and Wylie townships, Pembroke District, were reassessed in 1990 (Table 13).

At the Macaulay Township location, the number of trees in current dieback category "1" (6-20%) increased to 38% in 1990 from 22% in 1989, but the largest group of trees (49%) had 5% or less current dieback. In terms of cumulative dieback, 52% of the trees occurred in category "1".

Some recovery was observed in the plots in Alice and Wylie townships, where the majority of the trees (74 and 86%, respectively) had 5% or less current dieback. Under cumulative dieback, the largest number of trees occurred in category "2" (21-40%). Six trees in the Alice Township plot and one tree in the Wylie Township plot died in 1990. All but one of the dead trees had been recorded in category "4" (>60%) in 1989.

Table 12. A 3-year summary of sugar maple crown conditions recorded in four North American Maple Project (NAMP) plots established in 1988 in the Algonquin Region of Ontario.

Location (Twp)	Avg. DBH (cm)	Year	No. of trees examined	Total percentage of dead crown: Number of trees 0	1-5	6-15	16-25	26-35	36-45	46-55	56-65	66-75	>76	Trees dead	Trees down blown or cut
Bancroft District															
Cardiff[a]	20.2	1988	94	1	54	24	11	2	1	0	0	0	0[c]	0	0
		1989	94	0	28	50	12	2	0	0	0	0	0	2	0
		1990	92	0	38	35	4	6	2	1	3	1	0	4	0
Bangor[b]	37.1	1988	53	0	13	27	11	2	1	0	0	0	0	0	0
		1989	50	0	18	25	6	1	0	0	0	0	0	0	3
		1990	49	0	27	16	3	2	0	1	0	0	0	0	4
Bracebridge District															
Ridout[a]	25.4	1988	61	0	36	15	5	2	1	0	0	0	0	1	0
		1989	59	0	42	10	4	1	0	0	0	0	0	2	0
		1990	59	0	36	19	2	0	1	0	0	0	0	5	0
Franklin[b]	32.3	1988	44	0	32	8	3	1	0	0	0	0	0	0	0
		1989	44	0	29	12	1	1	1	0	0	0	0	0	0
		1990	44	0	25	14	0	3	1	0	0	0	0	0	0

[a] natural forest

[b] sugar bush

[c] One tree had 86-95% total dead crown.

Table 13. A 2-year summary of oak health at three locations in the Algonquin Region of Ontario (data based on an examination of 100 host trees at each location).

Location	Avg. DBH (cm)	Year	Current dieback[a]						Cumulative dieback[a]						Trees blown down or cut
			0	1	2	3	4	5	0	1	2	3	4	5	
			No. of trees												
Bracebridge District															
Macaulay Twp	35	1989	66	22	1	0	0	11	2	54	29	4	0	11	0
		1990	49	38	2	0	0	11	2	52	33	1	1	11	0
Pembroke District															
Alice Twp	18	1989	48	36	4	0	3	5	0	25	53	7	6	5	4
		1990	74	9	2	0	0	11	0	25	51	4	5	11	4
Wylie Twp	25	1989	58	33	0	0	0	9	0	11	65	15	0	9	0
		1990	86	4	0	0	0	10	0	23	59	7	1	10	0

[a] Dieback classification: 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = >60%, 5 = dead tree

SPECIAL SURVEYS

Pear Thrips, *Taeniothrips inconsequens* (Uzel)

As described in the 1989 Algonquin Region report, this introduced pest was first reported in the United States in California in 1904, but since then has expanded its range considerably. It attacks a number of plants, particularly fruit trees. However, the pear thrips has been recognized as a serious pest of hardwood forests since 1979, attacking maple, ash, birch, beech and black cherry (*Prunus serotina* Ehrh.) trees. Medium-to-heavy infestations have been reported in several states in the northeastern United States, including New York, Pennsylvania, Vermont, Massachussetts and New Hampshire.

Pear thrips adults are all small females, about the size of the head of a common pin. They emerge early in the spring and attack expanding buds, sucking the fluids out. The resultant damage resembles that of frost. Typical damage appears as mottled, tattered leaves, smaller-than-normal foliage, puckered and wrinkled foliage and fallen green leaves. Eggs are laid in the leaf petiole and along the mid-vein. Larvae emerge after the leaves have unfurled to about one third their normal size. Shortly afterwards (in 2 to 3 weeks), they drop to the ground and enter the soil, where they mature and overwinter. Growth loss and dieback have occurred outside of Ontario in areas where infestations have persisted the longest. According to the literature, thrips seem to prefer stressed trees.

In 1989, pear thrips were found throughout the range of sugar maple in Ontario. The pest was identified at eight locations in Algonquin Region last year, in the Algonquin Park, Bancroft and Pembroke districts. The collected thrips have not yet been identified beyond the family (Thripidae) level. Surveys of sugar maple continued in 1990 in parts of the Region not surveyed previously. Thrips (probably pear thrips) were recovered from sugar maple in Chaffey, Oakley, Strong and Watt townships, Bracebridge District, and Carling and Hagerman townships, Parry Sound District.

Damage typical of that caused by pear thrips, but which may or not have been caused by this pest, was observed at three locations in Bracebridge District in stands where the presence of thrips had been confirmed. About 1% of the foliage of 1- to 5-m-high sugar maple in Chaffey Township was puckered and wrinkled. Similar frost-like damage was noted on 1% of the foliage of 13-m sugar maple in Watt Township and an assessment of 15-m sugar maple in Oakley Township revealed that up to 60% of the foliage was blackened and wrinkled. Because of the timing of the survey, some of this damage may have been caused by frost.

Light Traps

Operation of the light trap at the Petawawa National Forestry Institute was once more carried out from 15 June to 31 July. The main purpose was to monitor the flight period of the spruce budworm, although the presence of a number of other major insects is recorded. The number of spruce budworm moths trapped in 1990 decreased to 30 from the 151 captured in 1989. Interestingly, the number of forest tent caterpillar adults decreased from 2,683 in 1989 to 897 in 1990. As well, 32 jack pine budworm adults were trapped in 1990, compared with none in 1989.

Climatic Data

Temperature and precipitation have a direct effect on both biotic and abiotic conditions, as can be seen from the occurrence of drought-related forest damage in the Region in 1989 and 1990. Table 15 summarizes the weather data for 1990 at two regional stations.

Table 15. Summary of mean temperature and total precipitation at two locations in the Algonquin Region of Ontario in 1990.

Location	Month	Mean temperature (°C) Normal	Mean temperature (°C) Actual	Deviation from normal (°C)	Total Precipitation (mm) Normal	Total Precipitation (mm) Actual	Deviation from normal (mm)
Bracebridge District							
Muskoka Airport							
	Jan.	-10.4	- 4.3	+6.1	85.9	100.3	+14.4
	Feb.	- 9.4	- 8.0	+1.4	62.4	54.8	- 7.6
	March	- 3.8	- 2.3	+1.5	66.3	40.4	-25.9
	April	+ 4.5	+ 5.9	+1.4	73.3	118.5	+45.2
	May	+10.9	+ 9.7	-1.2	77.8	100.5	+22.7
	June	+15.9	+16.3	+0.4	81.9	86.2	+ 4.3
	July	+18.3	+18.4	+0.1	77.5	102.4	+24.9
	Aug.	+17.4	+18.1	+0.7	89.0	40.0	-49.0
	Sept.	+13.2	+12.4	-0.8	102.4	99.8	- 2.6
	Oct.	+ 7.5	+ 6.3	-1.2	93.9	141.1	+47.2
	Nov.	- 1.1	+ 1.4	+2.5	101.0	162.3	+61.3
	Dec.	- 7.1	- 4.8	+2.3	97.8	118.1	+20.3
Pembroke District							
Petawawa Weather							
	Jan.	-12.8	- 7.3	+5.5	46.7	61.3	+14.6
	Feb.	-11.2	- 9.6	+1.6	51.0	36.9	-14.1
	March	- 4.6	- 3.6	+1.0	50.5	36.8	-13.7
	April	+ 4.2	+ 5.8	+1.6	59.6	75.8	+16.2
	May	+11.5	+10.2	-1.3	60.0	46.0	-14.0
	June	+16.3	+17.1	+0.8	87.5	114.2	+26.7
	July	+18.7	+19.2	+0.5	84.5	87.1	+ 2.6
	Aug.	+17.6	-	-	79.8	-	-
	Sept.	+12.6	+12.2	-0.4	83.1	58.2	-24.9
	Oct.	+ 7.1	+ 6.2	-0.8	66.7	103.2	+36.7
	Nov.	- 0.1	+ 0.3	+0.4	65.8	92.0	+26.2
	Dec.	- 9.7	- 8.4	+1.3	64.8	53.0	-11.8